



Comprehensive Review *of Recent Surface Force Incidents*



DEPARTMENT OF THE NAVY

U.S. FLEET FORCES COMMAND
1562 MITSCHER AVENUE, SUITE 250
NORFOLK, VA 23551-2487

October 26, 2017

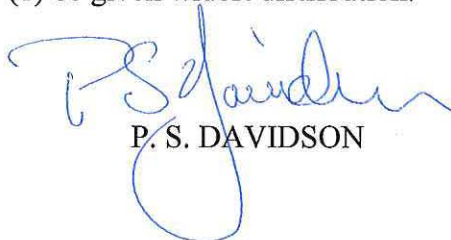
MEMORANDUM FOR VICE CHIEF OF NAVAL OPERATIONS

Subj: COMPREHENSIVE REVIEW OF RECENT SURFACE FORCE INCIDENTS

Ref: (a) Your memo of August 24, 2017

Encl: (1) Comprehensive Review of Recent Surface Fleet Incidents

1. Reference (a) directed that I lead a Comprehensive Review of surface fleet operations and incidents at sea that have occurred over the past decade with emphasis on SEVENTH Fleet operational employment to inform improvements Navy-wide. Enclosure (1) is the report of the final results of the Comprehensive Review.
2. The 33-member review team addressed individual training and professional development, unit-level training and operational performance, development and certification of deployed operational and mission standards, deployed operational employment and risk management, material readiness of electronic systems, and practical utility of current navigation equipment and combat systems.
3. The Comprehensive Review team conducted numerous site visits, document reviews, and interviews. The team received outstanding support from all organizations. I also received helpful input and insight from a panel of highly qualified experts to ensure the widest possible perspective.
4. As directed, the report makes detailed recommendations with respect to corrective actions necessary to ensure the safety of our people, safe operations at sea, and the readiness of our forces. I recommend that you appoint a flag officer with responsibility to follow through with the recommendations in this report. As part of this effort, formal written action plans should be developed and tracked at the unit, squadron, group, force, fleet, and other appropriate levels to ensure (1) individual responsibility and accountability for actions; (2) desired results are achieved; and (3) efforts are sustained over time.
5. In light of the public interest in the recent mishaps at sea and their implications for the Navy's readiness, I recommend that enclosure (1) be given widest distribution.


P. S. DAVIDSON

Copy to:
COMPACFLT

COMPREHENSIVE REVIEW OF RECENT SURFACE FORCE INCIDENTS

26 OCT 2017

Table of Contents

1. EXECUTIVE SUMMARY	5
1.1 Introduction	5
1.2 Summary of 2017 Mishaps	11
1.3 Summary of Findings and Actions	16
1.3.1 Poor seamanship and failure to follow safe navigational practices	16
1.3.2 Degraded watchteam performance.....	16
1.3.3 Erosion of crew readiness, planning and safety practices	17
1.3.4 Headquarters processes inadequately identified, assessed, and managed operational risks.....	17
1.3.5 Assessments do not reinforce effective learning	18
1.3.6 “Can-do” culture undermined basic watchstanding and safety standards	19
1.3.7 Surface ship Bridges not modernized as an integrated control room.....	19
1.4 Conclusion.....	20
2. METHOD OF REVIEW	23
2.1 Scope.....	23
2.2 Comprehensive Review Team membership	26
2.3 Structure of the Report.....	26
2.4 Areas for Further Study	27
3. SUMMARY AND ANALYSIS OF MISHAPS	29
3.1 Introduction	29
3.2 USS John S. McCain (DDG 56) Collision with ALNIC MC	29
3.3 USS Fitzgerald (DDG 62) Collision with ACX CRYSTAL.....	31
3.4 USS Lake Champlain (CG 57) Collision with Nam Yang 502.....	32
3.5 USS Antietam (CG 54) Grounding	33
3.6 Analysis of Past Incidents.....	34
3.6.1 Common Causal and Contributing Factors.....	35
3.6.2 Additional Important Factors.....	39
3.7 Summary Findings	40
3.7.1 Fundamentals	41
3.7.2 Teamwork	41
3.7.3 Operational Safety	41
3.7.4 Assessment.....	42

3.7.5	Culture	42
4.	INDIVIDUAL TRAINING	43
4.1	Introduction	43
4.2	Findings	46
4.2.1	Officer Training	47
4.2.2	Officer Career Path	49
4.2.3	Enlisted Training	52
4.3	Recommendations	54
4.3.1	Individual Training	54
4.3.2	Officer Career Path	56
5.	UNIT TRAINING	57
5.1	Introduction	57
5.2	Findings	59
5.3	Recommendations	63
6.	GENERATION AND EMPLOYMENT OF OPERATIONAL FORCES	65
6.1	Introduction	65
6.1.1	Force Generation	65
6.1.2	Force Employment	67
6.2	Findings	69
6.2.1	Force Generation	70
6.2.2	Force Employment	73
6.3	Recommendations	75
6.3.1	Force Generation	75
6.3.2	Force Employment	75
7.	SEAMANSHIP AND NAVIGATION EQUIPMENT READINESS AND UTILITY	77
7.1	Introduction	77
7.2	Findings	78
7.2.1	Inspection, Certification, and Assist Visits (ICAV)	78
7.2.2	Bridge System Modernization and Training	81
7.2.3	Human Systems Integration (HSI) and Human Factors Engineering (HFE)	87
7.3	Recommendations	89
8.	SYSTEMIC PROBLEMS	93
8.1	Introduction	93

8.2	Findings	94
8.2.1	Critical Assessment and Learning.....	94
8.2.2	Human Performance Factors.....	97
8.2.3	“Can do” Culture	101
8.2.4	Sustaining Change.....	103
8.3	Recommendations	105
8.3.1	Critical Assessment	105
8.3.2	Human performance factors	105
8.3.3	“Can do” culture	105
8.3.4	Sustaining change	106
9.	APPENDICES	107
9.1	Summary of Recommendations	107
9.2	Matrix of Mishap Attributes.....	115
9.3	Commands and Organizations Visited by CRT	117
9.4	Comprehensive Review Team Members.....	120
9.4.1	Independent Advisors	121
9.5	References.....	122
9.6	Acronyms	127
9.7	VADM (Ret) Balisle Fleet Review Panel Summary and Recommendations	131
9.8	Government Accountability Office and the Center for Naval Analyses Reports and Summary of Actions.....	148
9.9	History of Surface Warfare Officer School	162
9.10	Classified Appendix	173

1. EXECUTIVE SUMMARY

1.1 Introduction

The U.S. Navy's surface force responds daily to rigorous operational demands. In areas like the Western Pacific, the U.S. Navy has assured peace and stability in the region for over 70 years. During this time, skillful commanders at all levels have taken surface ships through all manners of difficult situations: through dangerous weather, multi-national search and rescue efforts, major combat operations, complex humanitarian support missions, theater security cooperation exercises with allies and partners, and all in accordance with international laws. The overall effect has assured freedom for all nations to use the seas to thrive and prosper. For the vast majority of all operational tasking, the surface force executes its missions safely and professionally.

The improvements in technology on U.S. Navy ships over the decades, particularly in propulsion, navigation and combat systems, have been met with more training, more qualifications, and a smarter, more able force of officers and Sailors. However, good seamanship and navigation practice still requires each surface ship to make paramount the requisites of good judgment, leadership, and teamwork, and to a very high degree, superior planning and execution of the fundamentals.

Standing together on the Bridge, the Commanding Officer (CO) and the Officer of the Deck (OOD), along with many other watchstanders, have to meet their challenges as a team. They have to voyage plan carefully, anticipate dangerous conditions, and combine their collective skills to effectively use the methods and techniques best suited to their ship, its equipment, and the conditions at hand. To be an effective team, all watchstanders have to learn to recognize the adequacy of their actions and provide forceful backup to correct potential hazards before a mishap occurs.

This is true at all levels of command. All watchstanders, from the most junior Sailor to the CO, have an obligation to use their voice to provide forceful backup when they see a deviation from procedure or dangerous situation developing. Command leadership, regardless of experience and rank, must have the humility to constantly encourage their subordinates to do the same. Corrective actions will be most effective when a culture of safety matures to the point where knowledge meets capability, and all

levels of command are operating interdependently, with greater teamwork, and with a heightened awareness of the adequacies of their actions.

Today, proficiency in seamanship and navigation competes for time and attention with the expanding tactical duties of our naval professionals at sea. Missions such as long range surface fires and land strike, air and missile defense of ships, allies and the homeland, anti-submarine warfare, and amphibious and mine operations are more complex than ever before, and require extensive training and focus. Further, the operational demands for surface ships to perform these missions continue to increase, even as the size of the surface force and the Navy has decreased.

This year, there have been three collisions and one grounding involving U.S. Navy ships in the Western Pacific. The two most recent mishaps involved separate incidents of a Japan-based U.S. Navy destroyer colliding with a commercial merchant vessel, resulting in the combined loss of 17 U.S. Sailors. Each of these accidents was investigated to determine specific causes, identify accountability, and disseminate lessons learned.

In their wake, the Vice Chief of Naval Operations (VCNO) assigned Commander United States Fleet Forces Command to lead a comprehensive review of these mishaps to determine the improvements or changes needed to make the surface force safer and more effective. As directed, this review addresses the following areas: individual training and professional development; unit level training and operational performance; development and certification of deployed operational and mission standards with particular emphasis on ships based in Japan; deployed operational employment and risk management; material readiness of electronic systems to include navigation equipment, surface search radars, propulsion and steering systems; and the practical utility and certification of current navigation and combat systems equipment including sensors, tracking systems, displays and internal communication systems. This 60-day review was undertaken by a diverse cross-section of talent from the surface force, as well as other services, warfare communities, industry, civilian maritime experts, academia, and other professions.

This review evaluated the aforementioned matters using a solution-oriented approach to identify gaps in Doctrine, Organization, Training, Material, Leadership and

Education, Personnel, and Facilities (DOTMLPF). The review found weaknesses in each of these areas. As examples: in Doctrine, the review found weaknesses in the way operational tasking is prioritized and issued to Japan-based ships; in Organization, variances were identified in headquarter staffs and the manner by which they execute command and control and manage the readiness of assigned forces; in Training, gaps were noted in the way seamanship and navigation skills are provided and assessed for individuals and teams on surface ships; for Material, inconsistencies and gaps were found in the configuration control and oversight of Bridge navigation systems; in Leadership and Education, deficiencies were noted in the leader's ability to identify, mitigate, and accept risks, and then learn rapidly from near-miss events and other hazards; in Personnel, gaps were identified in the qualification and proficiency of the surface force in seamanship and navigation; and in Facilities, gaps were identified in the shiphandling trainers and associated shore-based infrastructure in place to support training for safe seamanship and navigation at sea.

In the recent incidents, the U.S. Navy ships sustained catastrophic flooding, loss of critical systems, and 17 Sailors were killed. Yet, in periods of chaos and extreme conditions, Sailors rushed in to take emergency actions to save the ship, their shipmates, and restore critical systems. This does not happen without effective training, proficiency, discipline and toughness.

In each incident, there were fundamental failures to responsibly plan, prepare and execute ship activities to avoid undue operational risk. These ships failed as a team to use available information to build and sustain situational awareness on the Bridge and prevent hazardous conditions from developing. Moreover, leaders and teams failed as maritime professionals by not adhering to safe navigational practices.

Further, the recent series of mishaps revealed weaknesses in the command structures in-place to oversee readiness and manage operational risk for forces forward deployed in Japan. In each of the four mishaps there were decisions at headquarters that stemmed from a culturally engrained "can do" attitude, and an unrecognized accumulation of risk that resulted in ships not ready to safely operate at sea.

The recommendations to correct the weaknesses across the DOTMLPF addressed in this report are intended to instill the needed capabilities and proficiencies to make the surface force safer and more effective in the following five areas:

(1) **Fundamentals.** Basic skills such as seamanship and navigation, rigor in individual qualification processes, proficiency, and adherence to existing standards;

(2) **Teamwork.** The extent to which the surface force deliberately builds and sustains teams, and whether they are tested with realistic and challenging scenarios;

(3) **Operational safety.** The process and tools by which ships are made ready for tasking, ships are employed, and technology is used to safely operate at sea;

(4) **Assessment.** The extent to which ships and headquarters plan, critically self-assess, generate actionable lessons learned, and share knowledge across the force;

(5) **Culture.** The sum of the values, goals, attitudes, customs and beliefs of the surface force that defines its identity.

The recommendations described in this report address the skills, knowledge, capabilities, and processes needed to correct the abnormal conditions found in these five areas, which led to an accumulation of risk in the Western Pacific. The pressure to meet rising operational demand over time caused Commanders, staff and crew to rationalize shortcuts under pressure. The mishap reports support the assertion that there was insufficient rigor in seeking and solving problems at three critical stages: during planning in anticipation of increased tasking, during practice/rehearsal for abnormal or emergency situations in the mishap ships, and in execution of the actual events. This is important, because it is at these stages where knowledge and skills are built and tested. Evidence of skill proficiency (on ships) and readiness problems (at headquarters) were missed, and over time, even normalized to the point that more time could be spent on operational missions. Headquarters were trying to manage the imbalance, and up to the point of the mishaps, the ships had been performing operationally with good outcomes, which ultimately reinforced the rightness of trusting past decisions. This rationalized the continued deviation from the sound training and maintenance practices that set the conditions for safe operations.

The findings in chapters four through eight and appendix 9.10 underscore the imbalance between the number of ships in the Navy today and the increasing number of operational missions assigned to them. The Navy can supply a finite amount of forces for operations from the combined force of ships operating from CONUS and based abroad; this finite supply is based both on the size of the force as well as the readiness funding available to man, train, equip and sustain that force. Headquarters are working to manage the imbalance. U.S. Navy ships homeported in the continental United States (CONUS) balance maintenance, training and availability for operations (deployments and/or surge); the Pacific Fleet is re-examining its ability to maintain this balance for ships based in Japan as well. Under the Budget Control Act of 2011 and extended Continuing Resolutions, the ability to supply forces to the full demand is – and will remain – limited.

The demand for ready and certified ships to support operations required in the Western Pacific ultimately exceeded the quantity that could be generated from surface forces based in Yokosuka, and without an effective process to clearly define available supply and the associated readiness, risks were taken to provide these ships for dynamic and short notice tasking. With the exception of manpower, direct readiness funding to Japan-based ships was not a contributing factor, but funding shortfalls for capacity and readiness Navy-wide did have an impact in putting more pressure to meet increasing demand for Japan-based assets without additional support from CONUS-based ships. Additionally, with finite resources, the capacity and readiness of CONUS forces was also inadequate to help offset the deficit.

The risks that were taken in the Western Pacific accumulated over time, and did so insidiously. The dynamic environment normalized to the point where individuals and groups of individuals could no longer recognize that the processes in place to identify, communicate and assess readiness were no longer working at the ship and headquarters level.

Culturally, operating requirements around the globe will cause the surface Navy to remain biased toward mission execution. While that “can-do” culture has served us well in crisis and combat for decades, it does not relieve our commanders of the need to continuously assess, mitigate and accept risk. We should be careful about how we

make change to that culture. Recommendations in this report include actions that the Navy can take immediately to improve surface force safety and effectiveness, followed by near-term actions that the Navy can take in the next 30-150 days, as well as long-term actions to study for their potential ability to mitigate the risk of further mishaps. Additionally, the Navy should ensure the development of processes to enforce predictive standards of performance, improve collection of objective measures of human and unit performance, conduct assessments, and monitor predictive and leading trends so corrective actions are taken preemptively.

The primacy of efficiency over effectiveness and the impact that it has on readiness is not a new phenomenon. In 2009, after a decade of taking measures to increase efficiency in the surface Navy and other Navy programs an assessment of surface force readiness (commonly known as the Balisle report) was completed. It concluded that the totality of efficiency measures and efforts to reduce costs, such as the optimal manning initiative, increases to the Navy standard work week, and decreases in new Surface Warfare Officer (SWO) candidate training course lengths, directly contributed to a decline in surface force readiness.

The surface force embraced this finding and has deliberately tried to restore effective readiness to the force by increasing the number of people aboard ship, incrementally restoring SWO candidate training and implementing better maintenance management and training, among other improvements. While resources were restored, the restoration still had to be done in balance with modernization and force structure requirements. In many cases, deferred modernization has delayed the installation of modern integrated Bridge systems. Sailors from one ship cannot simply cross to another ship of the same class and expect familiar equipment or lay-outs. Low cost simulators do not sufficiently provide the fidelity to fully replicate the stresses of complex operations in high traffic areas.

Going forward, the Navy must develop and formalize “firebreaks” into our force generation and employment systems to guard against a slide in standards. We must continue to build a culture – from the most junior Sailor to the most senior Commander – that values achieving and maintaining high operational and warfighting standards of performance. These standards must be manifest in our approach to the fundamentals,

teamwork, operational safety, and assessment. These standards must be enforced in our equipment, our individuals, our unit teams, and our fleets. This Comprehensive Review aims to define the problems with specificity, and offers several general and specific recommendations to get started on making improvements to instilling those standards and strengthen that culture.

1.2 Summary of 2017 Mishaps

USS John S. McCain (DDG 56) Collision with ALNIC MC

On the morning of 21 August 2017 USS John S. McCain was preparing to enter the Singapore Strait for transit to Sembawang, Singapore. The ship completed a full Navigation Brief the day before that included the estimated time of 0500 to enter the Traffic Separation Scheme (TSS) and subsequent passage in close proximity to shoal water. Although the Executive Officer (XO) and Navigator recommended setting the Sea and Anchor Detail at 0500, the CO decided to delay stationing the detail until 0600 in order to give the crew more time to rest and to minimize the chance of a man overboard during hours of darkness. As mitigation, the CO planned to be on the Bridge for the entire transit and in fact arrived on the Bridge at 0115 and remained there until after the collision.

Of the Bridge watchstanders, the Junior Officer of the Deck (JOOD), the Boatswain's Mate of the Watch (BMOW), and the eventual Lee Helmsman (Lee Helm) were on temporary duty from the USS Antietam (CG 54) to provide these Sailors underway time for qualifications while USS Antietam was under-going repairs. Although the watchbill listed the USS Antietam Sailors as qualified, the BMOW and JOOD qualification dates coincided with the day they reported to USS John S. McCain, and they conducted no requalification events. The Lee Helm qualified as Helm/Lee Helm within a few weeks of reporting to USS John S. McCain.

After entering the TSS, the CO noticed that the Helmsman was having difficulty both steering the ship and adjusting the ship's speed due to prevailing environmental conditions. The CO ordered the OOD to separate the control of steering and thrust to two separate stations: the Helm and Lee Helm. While attempting to execute this order, the Bridge watchstanders unintentionally transferred steering control to the Lee Helm

console and “un-ganged” the throttles (i.e., separated the port and starboard throttle controls from a coupled control to individual throttle control). Complicating the execution of the order was a series of watch reliefs for meals then in progress among the various watchstations and a lack of posted procedures for transfer of throttle and steering control. Recognizing that he no longer had control of steering, the Helmsman announced a loss of steering (system) casualty (malfunction). The After Steering station was manned in short order and attempted to take emergency control. Due to confusion on the Bridge about the nature of the casualty and the operation of the Ship’s Control Console (SCC), steering control would be inadvertently transferred among various controlling stations four times within the two minutes leading up to the collision. As a result of this perceived lack of steering control, the ship began a slow turn to port.

After hearing the Loss of Steering casualty the CO directed the OOD to slow the ship. The OOD ordered 10 knots and the Conning Officer duly gave the order. The Lee Helm executed the order and slowed the port shaft, but did not recognize that the throttles were not linked and that he had control only of the port shaft. Unrecognized by the watchteam, control of the starboard shaft remained at the Helm station for more than 60 seconds after control of the port shaft was taken by the Lee Helm. The speed change to the port shaft slowed the ship but also increased USS John S. McCain’s rate of turn to port as the starboard engines and shaft remained ordered to 20 knots. The CO then ordered a speed of 5 knots, but the Lee Helm’s actions only reduced power to the port shaft due to the individual throttle control. The starboard shaft still remained at 20 knots, exaggerating the rate of turn even further. About three minutes after the reported Loss of Steering casualty began, USS John S. McCain regained positive steering control in After Steering and answered Right 15 degrees rudder. About this same time throttles were matched at the Lee Helm and the starboard engine and shaft slowed to 5 knots. These actions were too late to avoid collision with the ALNIC. At about 0524, and because of the port turn induced by the loss of steering control and thrust control actions, the USS John S. McCain crossed in front of ALNIC, whom the USS John S. McCain had just passed ahead of, and USS John S. McCain was struck on her port quarter. Despite what the watchstanders believed, there never was a loss of steering casualty.

Primary causes of the collision were leaderships' loss of situational awareness in a high traffic area and failure to follow safe navigational practices, coupled with watchstanders who were not proficient with steering control operations or engineering casualty response procedures. Contributing to the collision were failures in basic watchstanding and seamanship among the Bridge and Combat Information Center (CIC) teams; a failure by these same watchteams to take clear and decisive action to avoid collision when in extremis; and the failure of the Commanding Officer in assigning and changing watchstanders, in ordering equipment configuration changes in the TSS, and in failing to take prudent measures to mitigate these risks. This critique of USS John S. McCain does not imply that ALNIC mistakes and deficiencies were not contributing causal factors in the collision.

USS Fitzgerald (DDG 62) Collision with ACX CRYSTAL

On 17 June 2017, USS Fitzgerald was attempting to cross a highly congested sea lane at night. While maneuvering to pass merchant and fishing vessels and complete the crossing, watchstanders failed to visually differentiate between two vessels in close proximity and did not calculate the closest point of approach using all available means before making a final crossing maneuver. Watchstanders in CIC were inattentive, disengaged in developments on the Bridge, and unaware of several nearby vessels, specifically, a Philippines-flagged commercial containership named the ACX CRYSTAL.

As the CRYSTAL and USS Fitzgerald approached each other, the OOD became aware of the ships' relative positions and realized action was necessary. The OOD first decided to alter course to starboard, but then evaluated there was insufficient sea room to turn to starboard without colliding. The OOD then ordered the Conning Officer to come to full speed, and then flank speed ahead, and then ordered a full, and then hard left rudder. The actions were delayed as the Conning Officer "froze" in the moment. The OOD and the Conning Officer both began to shout orders to the helm. Eventually, the Boatswain's Mate of the Watch put the rudder over hard left and pushed the ship's throttles forward. These actions occurred just 30 seconds prior to the impact, and the

USS Fitzgerald had briefly started coming left and increasing speed by the time of impact.

The merchant vessel's port bow (left front) impacted USS Fitzgerald's starboard side amidships (right middle). At no time leading up to the collision did the USS Fitzgerald or CRYSTAL watchstanders attempt to communicate over radio, or take decisive action to avoid collision.

The collision resulted from a compilation of failures by leadership and watchstanders to plan for safety, appropriately adhere to sound navigation practices, execute basic watchstanding principles, properly use navigation tools, and deliberately and effectively respond when in extremis. This critique of USS Fitzgerald does not imply that CRYSTAL mistakes and deficiencies were not contributing causal factors in the collision.

USS Lake Champlain (CG 57) Collision with Nam Yang 502

On 9 May 2017, USS Lake Champlain was escorting an aircraft carrier. A Republic of Korea fishing vessel, Nam Yang 502 was operating in the same area, with USS Lake Champlain watchstanders intermittently tracking Nam Yang 502 for over an hour on a constant course and speed. USS Lake Champlain watchstander awareness of the vessel was inconsistent due to their poor RADAR operating technique and some inoperable commercial radar (backup) equipment. The Bridge and CIC watchteams were undisciplined in their communications and failed to coordinate common situational awareness and agreement on the safety of planned maneuvers. While changing course to maintain relative position with the escorted aircraft carrier, the USS Lake Champlain turned in front of the fishing vessel without realizing the risk of collision. The Bridge watchteam was slow to react and executed improper and untimely maneuvers in an attempt to avoid collision, and the Nam Yang 502 struck USS Lake Champlain amidships on the port side.

Minutes before the collision, USS Lake Champlain's Bridge watchstanders attempted to contact Nam Yang 502 on the radio and simultaneously signaled the fishing vessel using the ship whistle. Nam Yang's global positioning system and radio

were not working properly. Further, Nam Yang did not attempt to communicate with USS Lake Champlain or take immediate action to avoid collision.

The collision occurred because an inexperienced Bridge team failed to follow safe navigational practices and take proper actions to avoid collision. This critique of USS Lake Champlain does not imply that Nam Yang mistakes and deficiencies were not contributing causal factors in the collision.

USS Antietam (CG 54) Grounding

On 31 January, 2017, USS Antietam moved from her berth in Yokosuka to an anchorage in Tokyo Bay to take on supplies before a planned transit to conduct local area training. The navigation plan and brief noted the prevailing environmental conditions (high wind and current) but did not account for them during the approach to anchorage. After maneuvering to avoid shipping, USS Antietam turned to its anchorage using a different approach course than planned. Wind and current pushed USS Antietam south of the intended anchorage point, toward the nearest charted shoal. USS Antietam was 114 yards away from the planned anchorage point when the order to “let go the anchor” was given, however, the CO believed the ship was only 50-75 yards away from the planned anchorage.

The dropping of the anchor was delayed because a retaining pin had been inserted backwards, making it difficult for deck personnel to remove it. When the anchor was finally released, the ship used less than half the amount of chain required to hold the ship in place under that day’s conditions. Recognizing continued wind-induced drift toward the shoal, the CO decided to bring up the anchor and reposition to the planned anchorage point. Internal miscommunication delayed anchor retrieval. As USS Antietam continued to drift toward the shoal, the CO delayed adding power or maneuvering into the wind until the anchor was retrieved, believing the greatest risk was damaging the ship’s SONAR dome by increasing speed while the anchor was underfoot. Once the anchor was retrieved and as power was added, the blades of both propellers struck bottom.

The grounding was a result of the Bridge watchteam’s failure to counter USS Antietam’s movement towards shoal water, poor seamanship while anchoring,

leadership's delayed response when steering into danger, and the watchteams inability to provide forceful backup in an extremis situation.

1.3 Summary of Findings and Actions

1.3.1 Poor seamanship and failure to follow safe navigational practices

In each case, Bridge and CIC watchstanders did not maintain situational awareness and recognize that a significant error chain was in motion. Once confronted with an extreme situation, watchstander actions failed to comply with procedures as outlined in governing directives, as well as common customs of service, such as standard commands. Additionally, watchstanders did not take emergency actions, to include sounding alarms, signaling to the other ship, or warning the crew. In every mishap, departures from procedures or approved customary practices were deemed to have directly contributed to the mishap.

Action: *Improve seamanship and navigation individual skills training* for Surface Warfare Officer candidates, Surface Warfare Officers, Quartermasters and Operations Specialists.

Action: *Create an objective, standardized assessment program* to periodically assess individual seamanship and navigation skills over the course of a Surface Warfare Officer's career.

Action: Numbered Fleet Commanders establish appropriate policies for surface ships to actively transmit and use Automatic Identification System (AIS) when transiting high traffic areas.

1.3.2 Degraded watchteam performance

Each of the four Bridge and CIC teams involved in the mishaps did not work with each other to solve problems as an effective team. Command leadership on these ships failed in their absolute responsibility to develop and properly balance their watchteams with depth and experience to foster consistent superior performance. Bridge and other CIC watchstanders did not perform their duties as primary advisors to the OOD for the safe navigation of the ship as required by Commanding Officer's Standing Orders and higher level instructions.

Action: *Improve current seamanship and navigation team training and certifications to include assessment in emergency and in extremis environments.*

Action: *Improve shore-based Bridge trainers and add CIC functionality to team training facilities.*

Action: *Integrate Bridge and CIC evaluations for unit level seamanship and navigation training scenarios in shore-based team trainers, and during at sea training and certifications events.*

1.3.3 Erosion of crew readiness, planning and safety practices

The readiness generation model for ships based in Japan does not support the training needs for these ships. The increase in operating tempo in the Western Pacific combined with longer and more complex maintenance and modernization periods, has effectively reduced the amount of time Yokosuka-based ships have to train and certify in the existing Forward Deployed Naval Force (FDNF) – Japan readiness generation model. FDNF-Japan surface forces must be committed to a new model tailored to supporting operational requirements while preserving time for maintenance and training. This review endorses COMPACFLT's actions to conduct a hull-by-hull material review of FDNF-Japan ships' material condition, review the certifications of each FDNF- Japan ship, and implement a zero-based readiness review of the FDNF Japan continuous readiness generation cycle.

Action: *Conduct comprehensive Ready for Sea Assessments to determine the material and operating readiness for all Japan-based ships.*

Action: *Develop a force generation model for ships based in Japan that addresses the increasing operational requirements, preserves sufficient maintenance and training time, and improves certification accomplishment.*

1.3.4 Headquarters processes inadequately identified, assessed, and managed operational risks

Higher headquarters readiness processes were not rigorously executed to provide leadership appropriate information to make employment decisions. The mitigation plans developed for expired training certifications for Yokosuka-based ships almost universally identified insufficient training time to complete the certifications as a cause, and rescheduling of training as the mitigation. As a result, employment

decisions were made without adequate assessment of the readiness risk of reduced training. Additionally, no independent organization was providing oversight to the certification process to ensure standards were maintained.

Action: Permanently establish Naval Surface Group Western Pacific as an echelon 4, Immediate Superior in Command administrative headquarters responsible for maintaining, training and certifying FDNF Japan ships.

Action: Restore the SEVENTH FLEET deliberate employment scheduling process to improve operational planning and risk management.

Action: Cancel all existing Risk Assessment Mitigation Plans (RAMP) until all Ready for Sea Assessments (RFSA) are complete.

Action: Establish a single Echelon 2 higher headquarters responsible for the readiness generation of all Navy forces.

1.3.5 Assessments do not reinforce effective learning

Surface ships, Type Commanders headquarters, and safety organizations have not all instituted a culture of critical assessment and continuous improvement. Unit evaluation processes are mainly focused on analyzing specific events and do not provide a broader view of performance over time. Additionally, the numerous external assessments that are performed do not always provide sufficient critical examination of a crew's performance to drive learning and improvement. Safety programs and safety reporting and analysis systems to develop and promulgate lessons learned and feedback from significant events are also inadequate. The lack of objective performance measures prevents the identification of trends so action can be taken on problems before they become hazardous.

Action: Perform a baseline review of all inspection, certification, assessment and assist visit requirements to ensure and reinforce unit readiness, unit self-sufficiency, and a culture of improvement.

Action: Establish and utilize near miss reporting processes to share lessons across the surface force.

Action: Improve Naval Safety Center and fleet and force headquarters safety programs and data analysis to provide predictive operational safety and risk information.

1.3.6 “Can-do” culture undermined basic watchstanding and safety standards

Historically, our can-do culture has often differentiated us from our adversaries and has been pivotal in bringing victory against overwhelming odds. A can-do culture, when self-inspired, is a virtue that the Navy relies on to be successful. The can-do culture becomes a barrier to success only when directed from the top down or when feedback is limited or missed. We want that can-do culture and must build the experience and temperament in our Commanders and crews that will reinforce its virtue. The prevailing belief of Japan-based ships and higher headquarters was that a high pace of operations equates to a high state of proficiency. In part, this belief led to an undervaluing of human performance factors, such as fatigue. When combined with an absence of foundational training and critical assessment, this attitude induced a slow erosion of standards, and organizational drift from the deliberate processes used to manage time, resources, rest and a commitment to safety as a way of operating.

Action: *Improve Operational Risk Management training and education at all Surface Warfare Officer School milestone courses.*

Action: *Establish a comprehensive fatigue and endurance management policy to implement fatigue recovery standards and codify a circadian ship and watch rotation routine for surface ships.*

Action: *Establish human performance expertise at all Type Commander staffs.*

1.3.7 Surface ship Bridges not modernized as an integrated control room

U.S. Navy Bridge equipment modernization has occurred without centralized oversight of the cumulative effect of equipment and configuration changes on the Bridge. Technology intended to simplify navigation, improve situational awareness for smaller watchteams, and increase flexibility for ship control is complex, and in some cases, more difficult to operate. Force wide, the transition from legacy to modern systems has been slowed due to lack of funding and has resulted in unique Bridge configurations and wide variances in configurations from ship-to-ship, even within the same ship class. However, from the perspective of individual ships, technological change can appear rapid and disjointed. Gaps between the foundational training provided to enlisted crewmembers, and the complexity of the technology used in

modern ship control consoles, make it difficult for ships' personnel to retrain and requalify for operating and technical proficiency.

Action: *Consolidate responsibility and authority for Bridge system modernization and improve methods for human systems integration.*

Action: Establish formal policy for requalification requirements for personnel temporarily assigned to ships and when changes in equipment configuration occur.

Action: *Accelerate plans to replace aging military surface search radars and electronic navigation systems.*

Action: *Improve stand-alone commercial radar and situational awareness piloting equipment through rapid fleet acquisition for safe navigation.*

1.4 Conclusion

The U.S. Navy operates in an environment constantly subject to change. Amidst these changes, the Navy is expected to adapt quickly and operate effectively. Many of its leaders resourcefully find ways to generate strong teams in this environment and use resources effectively to succeed. However, continued success is not guaranteed. The surface force must seek and trend precursors that lead to significant mishaps at sea. The commonalities among the four mishaps discussed in this document originated in a failure to properly plan and prepare, and ultimately manifested in unnecessarily pressurized execution of these important seamanship evolutions. Systemic issues at higher levels also adversely affected organizational processes at the unit level. Even when presented with information that indicated standards of readiness were not met, rather than taking pause and determining what was needed to correct the problem, the force was conditioned to mitigate the risk only through the delay of some training action that would ultimately lessen the impact on operational missions, and then proceed on those same missions without real risk mitigation.

All levels of command must evaluate the sufficiency of internal programs and processes to self-assess, trend problems, and develop and follow-through on corrective actions. This kind of assessment must be an integral part of our everyday culture, as it is an essential aspect of ensuring the Navy's ability to safely and effectively perform its missions at sea. Continuous improvement processes must account for human factors

in individual and team performance, to include individual and operational fatigue. These factors may determine mission outcomes regardless of other readiness indicators. Knowing that human induced errors are part of any system, we must account for them as risks to be mitigated for overall mission accomplishment, whether the team is a division, a ship, or a Fleet, System Command or Type Command headquarters. Effective internal and external assessments that document these tendencies reduce vulnerabilities, and will improve Navy's surface force operational effectiveness at all levels.

Some of the challenges identified by this comprehensive review are not unique to the surface force. The increasing demand for forces, ever-pressurized maintenance cycles, and understanding the human performance elements of operational safety cut across all Navy communities. As such, each community leader should examine the results of this comprehensive review and assess the principles of the findings for broader applicability.

Accordingly, there must be more consistent and disciplined processes at the Fleet and Type Commander staffs, with clear guidance, responsibility, authority, and accountability for readiness, training and operations. This will set the conditions for our ships to maintain the highest levels of readiness and superior performance in the missions the Navy asks of them. Similarly, effective improvements to surface force operations and training can also be made at the command level so that ships, squadrons and crews are trained, certified, rested, responsive, and ready to go.

[PAGE INTENTIONALLY LEFT BLANK]

2. METHOD OF REVIEW

2.1 Scope

Over the past decade U.S. Navy ships have been involved in 12 major at-sea mishaps (collisions, allisions, or groundings), including four incidents this year in the Western Pacific. Each of these mishaps was followed by in-depth investigations into the root causes leading to the incidents. These individual investigations were accompanied by recommendations intended to provide lessons to be learned and to prevent a singular causal or contributing condition from reoccurring in the future. These lessons and other changes were meant to instill individual unit improvements and did not examine the institutional Doctrine, Organization, Training, Material, Leadership and Education, Personnel, and Facilities (DOTMLPF) conditions that might be external factors in these mishaps.

Learning involves recognizing the adequacy of our actions and correcting potential hazards before a mishap occurs. Corrective actions will be most effective when a culture of safety matures to the point where knowledge meets capability, and all levels of command are operating interdependently, with greater teamwork at their respective levels, and a heightened awareness of the adequacies of their actions with respect to the Navy's goals.

Leadership typically goes through several phases following a major mishap: ordering an operational pause or safety stand down; assembling a team to determine what happened and why; and developing a list of discrete actions for improvement. Causes are identified, meaningful actions taken, and there has been repeated near-term success in instilling improved performance. However, these improvements may only have marginal effect in the absence of programs and processes to ensure lessons are not forgotten. Still, all levels of command must evaluate the sufficiency of internal programs and processes to self-assess, trend problems, and develop and follow through on corrective actions in the wake of mishaps.

In August 2017, the Vice Chief of Naval Operations (VCNO) assigned Commander United States Fleet Forces Command to lead a comprehensive review of surface ship operations and incidents at sea to determine improvements or changes

needed to make the surface force safer and more effective. The Comprehensive Review Team (CRT) examined the significant surface mishap investigation reports over the past ten years, conducted field observation, interviews, and focus group discussions at various echelon levels from individual units to the Fleet Commander, and reviewed source documentation defining requirements for and execution of force generation and force employment models, as well as training curricula and equipment design criteria and utilization. The areas specified in the VCNO memorandum directing the comprehensive review of recent surface ship incidents include:

- a. **Individual training** and professional development to include seamanship, navigation, voyage planning, leadership development, and officer and enlisted tactical training in formal schools and on the job.
- b. **Unit level training** and operational performance, to include manning, personnel management, watch bill management, Bridge (and CIC) team resource management, contact management, contact avoidance, leadership oversight, and risk assessment/mitigation at all levels of the chain of command.
- c. Development and certification of deployed operational and mission standards (**Force Generation**) with particular emphasis on Forward Deployed Naval Forces (FDNF), to include validation of required certification standards, gaps between required standards and actual employment practices, effectiveness of leadership and oversight at all levels of the administration and operational chains of command, maintaining and enforcing standards throughout FDNF assignment including self-assessment practices, external inspection reinforcement, and remedial action mitigation plans.
- d. Deployed Operational Employment and Risk Management (**force employment**), to include Combatant Commander mission requirements, theater security cooperation requirements, maintenance impacts, other competing priorities (experimentation, concept development), and their corresponding impact to operational tempo (OPTEMPO) and fundamental navigation and seamanship proficiency.

- e. **Material readiness** of electronic systems to include navigation equipment (e.g. AIS, radars, ECDIS, VMS, WSNs), propulsion and machinery to include steering systems, combat system modernization, and material availability.
- f. **Practical utility** of current navigation equipment and combat systems including sensors, tracking systems, displays, and internal communications networks to evaluate their effectiveness at integrating tactical data and providing situational awareness to our people.

This review evaluated the aforementioned matters using a solution-oriented approach to identify gaps in DOTMLPF. The review found weaknesses in each of these areas and as a result makes recommendations for DOTMLPF improvements to make the surface force safer and more effective.

The cumulative results of the findings and recommendations in this report go a step beyond the individual and collective actions that are needed. The recommended changes, i.e., the things the Navy must go and do, are based on the conclusion that the actions taken in the wake of these mishaps can help instill the knowledge, capabilities and proficiencies necessary for improvements in these five areas:

(1) **Fundamentals.** Basic skills such as seamanship and navigation, rigor in individual qualification processes, proficiency, and adherence to existing standards;

(2) **Teamwork.** The extent to which the surface force deliberately builds and sustains teams, and tests them with realistic and challenging scenarios;

(3) **Operational safety.** The process and tools by which ships are made ready for tasking, ships are employed, and technology is used to safely operate at sea;

(4) **Assessment.** The extent to which headquarters plan, critically self-assess, generate actionable lessons learned, and share knowledge across the force;

(5) **Culture.** The sum of the values, goals, attitudes, customs and beliefs of the surface force that defines its identity.

2.2 Comprehensive Review Team membership

The Comprehensive Review Team (CRT) consisted of 34 servicemen and women and civilians. The team consisted of a range of subject matter experts, to include personnel with extensive experience in afloat leadership; underway operations, including the Western Pacific operating area; institutional training; equipment and systems research, development, and acquisition; and ship maintenance. It included civilian experts, and military members from other Navy warfare communities and from other services. Multiple members also had substantial experience in conducting major inquiries and audits. A complete roster of team members is included in Appendix 9.4.

The VCNO also directed U.S. Fleet Forces Command to seek input and insight from other services, industry and highly qualified experts outside the Services as the comprehensive review of surface ship incidents was conducted. Several distinguished individuals were appointed to advise the CRT during the course of the review, and are included in Appendix 9.4.1.

2.3 Structure of the Report

This report is organized in chapters that analyze the major elements of the VCNO's Memorandum. Chapter three provides a summary of the four 2017 mishap events involving USS John S. McCain, USS Fitzgerald, USS Antietam, and USS Lake Champlain. This section also describes common causal factors among these mishaps, and was informed by other mishap events that have occurred over the past ten years. All four 2017 mishaps illustrated a breakdown in fundamentals, teamwork, operational safety, assessment, and culture. Chapters four through eight provide detailed findings and recommendations related to the following areas, respectively: individual training; unit level training; development and certification of operational forces, mission employment and operational safety; seamanship and navigation equipment readiness and utility; and systemic problems and recommendations to improve the mission culture in the surface force. The appendices contain supporting documentation, including a matrix of factors in each of the four mishaps; a list of commands visited or personnel interviewed as part of this review.

2.4 Areas for Further Study

The following areas were identified by the review, but were not considered in depth due to time constraints and/or security needs. These should be considered for additional review and analysis: force structure, to include Navy Integrated Air and Missile Defense capacity; improving acquisition processes to fully account for training and integrated logistics support; improving processes that support learning across the Navy (i.e., between warfare communities); and improvements in damage control. Finally, while the Navy concluded cyber-attack was not a factor in either the USS John S. McCain-ALNIC collision or the USS Fitzgerald-ACX CRYSTAL collision, continued study is recommended on cyber vulnerabilities of surface ship propulsion and navigation systems.

[PAGE INTENTIONALLY LEFT BLANK]

3. SUMMARY AND ANALYSIS OF MISHAPS

3.1 Introduction

This review examined each of the major mishaps that occurred since 2007. Below are summaries of each of the four mishaps that occurred in 2017 beginning with the most recent, and a listing of mishaps from the previous ten years. This chapter summarizes the causal, contributing, and additional important factors common among the events. Causal factors are those elements or events that, if corrected, would have interrupted the chain of events and prevented the incidents from occurring. Contributing factors are elements or events that, if corrected, might have prevented the incident from occurring. Additional important factors are germane to these incidents and related incidents at sea but are not a direct contributor to the event. This critique of U.S. Navy vessels does not imply that other vessels' mistakes and deficiencies were not contributing causal factors in the collision.

3.2 USS John S. McCain (DDG 56) Collision with ALNIC MC

On the morning of 21 August 2017 USS John S. McCain was preparing to enter the Singapore Strait for transit to Sembawang, Singapore. The ship completed a full Navigation Brief the day before that included an estimated time of 0500 to enter the Traffic Separation Scheme (TSS) and passage in close proximity to shoal water. Although the Executive Officer (XO) and Navigator recommended setting the Sea and Anchor Detail at 0500, the CO decided to delay stationing the detail until 0600 in order to give the crew more time to rest and to minimize the chance of a man overboard during hours of darkness. As mitigation, the CO planned to be on the Bridge for the entire transit and in fact arrived on the Bridge at 0115 and remained there until after the collision.

Of the Bridge watchstanders, the Junior Officer of the Deck (JOOD), the Boatswain's Mate of the Watch (BMOW), and the eventual Lee Helmsman (Lee Helm) were on temporary duty from the USS Antietam (CG 54) to provide these Sailors underway time for qualifications while USS Antietam was undergoing repairs. Although the watchbill listed the USS Antietam Sailors as qualified, the BMOW and JOOD qualification dates coincided with the day they reported to USS John S. McCain, and

they conducted no requalification events. The Lee Helm qualified as Helm/Lee Helm within a few weeks of reporting to USS John S. McCain. The Conning Officer was a new ensign who joined the ship two months before the collision and had not attended the Basic Division Officer Course.

After entering the TSS, the CO noticed that the Helmsman was having difficulty both steering the ship and adjusting the ship's speed due to prevailing environmental conditions. He ordered the OOD to split the steering and throttle control between two stations, the Helm and Lee Helm. While attempting to execute this order, the Bridge watchstanders unintentionally transferred steering control to the Lee Helm console and "un-ganged" the throttles (uncoupled the throttle control so the left throttle controls the port propulsion shaft and the right throttle controls the starboard shaft). Complicating the execution of the order was a series of watch reliefs for meals then in progress among the various watchstations and a lack of posted procedures for transfer of throttle and steering control. Recognizing that he no longer had control of steering, the Helmsman announced a loss of steering (system) casualty (malfunction). The After Steering station was then manned in short order and attempted to take control. Due to confusion on the Bridge about the nature of the casualty and the operation of the Ship's Control Console (SCC), steering control was inadvertently transferred among various controlling stations four times within the two minutes leading up to the collision. During this time the ship began a slow turn to port. After hearing the Loss of Steering casualty the CO directed the OOD to slow the ship. The OOD ordered 10 knots and the Conning Officer duly gave the order. The Lee Helm executed the order and slowed the port shaft, but did not recognize that the throttles were not linked and that he had control only of the port shaft. Unrecognized by the watchteam, control of the starboard shaft remained at the Helm station for more than 60 seconds after control of the port shaft was taken by the Lee Helm. The speed change to the port shaft slowed the ship but also increased USS John S. McCain's rate of turn to port as the starboard engines and shaft remained ordered to 20 knots. The CO then ordered a speed of 5 knots, but the Lee Helm's actions only reduced power to the port shaft due to the individual throttle control. The starboard shaft still remained at 20 knots, exaggerating the rate of turn even further. About three minutes after the reported Loss of Steering casualty began,

USS John S. McCain regained positive steering control in After Steering and answered Right 15 degrees rudder. About this same time throttles were matched at the Lee Helm and the starboard engine and shaft slowed to 5 knots. These actions were too late to avoid collision with the ALNIC. At about 0524, and because of the port turn induced by the loss of steering control and thrust control actions, the USS John S. McCain crossed in front of ALNIC, whom the USS John S. McCain had just passed ahead of, and USS John S. McCain was struck on her port quarter. Technically, there never was a loss of steering casualty.

Primary causes of the collision were leaderships' loss of situational awareness in a high traffic area and failure to follow safe navigational practices, coupled with watchstanders who were not proficient with ship control console operations (steering and throttle control) or associated casualty response procedures. Contributing to the collision were failures in basic watchstanding and seamanship among the Bridge and CIC teams; a failure by these same watchteams to take clear and decisive action to avoid collision when in extremis; the failure of the Commanding Officer to properly assess risk in setting Sea and Anchor detail, changing watchstanders and equipment configurations in the Traffic Separation Scheme (TSS), the presence of nearby shipping, and to take prudent measures to mitigate said risks. This critique of USS John S. McCain does not imply that ALNIC mistakes and deficiencies were not contributing causal factors in the collision.

3.3 USS Fitzgerald (DDG 62) Collision with ACX CRYSTAL

On 17 June 2017, USS Fitzgerald, based in Yokosuka, Japan, was transiting in calm seas with clear visibility from a near-Japan shore training area to conduct routine operations in the Western Pacific. Her planned navigation track required her to transit a highly trafficked area known as the Sagami-Wan at relatively high speed. After midnight, with traffic increasing, USS Fitzgerald maneuvered to pass and avoid several merchant and fishing vessels. At the time, Bridge and CIC watchstanders were not employing all sensors to maintain a clear picture of ships in their area, did not calculate predicted closest-points-of-approach for traffic, and did not share information and intentions among the team on watch and with the Commanding Officer.

As USS Fitzgerald approached the point of collision, Bridge and CIC watchstanders were poorly monitoring surface traffic and as a result were unaware of multiple contacts within ten miles of the ship. Shortly after 0100, a crossing situation developed between USS Fitzgerald and three large on-coming merchant vessels, all of which were transmitting on AIS. The merchant ships were traveling in close proximity to each other on similar courses with two overtaking the third. The OOD decided to maintain course and speed, predicting that USS Fitzgerald would cross 1500 yards ahead of what she recognized as a crossing vessel with the right of way, and began to prepare a contact report to inform the CO. Shortly before the collision, the JOOD sighted visually, and informed the OOD of a closer than anticipated contact, the ACX CRYSTAL to starboard and recommended slowing. The OOD, confused between what she saw and what she intended with the crossing situation, ordered right full rudder in order to pass behind the merchant. However, before that order was executed, in an attempt to turn away from the merchant, the OOD reassessed and improperly ordered the conning officer to come to full speed, and then flank speed ahead, and then ordered a full, and then hard left rudder. Simultaneously, the ACX CRYSTAL began to turn to the right. Neither the USS Fitzgerald's or ACX CRYSTAL's final maneuvers were effective to steer clear of danger. At 0130, the merchant vessel's port bow (left front quarter) impacted USS Fitzgerald's starboard side amidships (right middle) and caused significant damage above and below the waterline. Seven U.S. Sailors were killed, and three were injured. This critique of USS Fitzgerald does not imply that CRYSTAL mistakes and deficiencies were not contributing causal factors in the collision.

3.4 USS Lake Champlain (CG 57) Collision with Nam Yang 502

On 9 May 2017, USS Lake Champlain, homeported in San Diego, was underway on deployment in the Sea of Japan and assigned to operate in a position to screen a nearby aircraft carrier on a clear, relatively calm day. The CO had departed the ship via helicopter for a meeting on the aircraft carrier, the XO was in her stateroom, and the ship was conducting maintenance on one of its four engines.

A fishing vessel in the area, the Nam Yang 502, had been on a constant course and speed for over an hour, and was transmitting its unique identification, position,

course and speed on its Automatic Identification System (AIS). Both USS Lake Champlain and the aircraft carrier had positive radar and AIS contact on the fishing vessel, had correlated the Nam Yang 502 in the tactical link between ships, and the vessel had been visually spotted by USS Lake Champlain lookouts. However, USS Lake Champlain radar and AIS contacts, and the crew's awareness of them, were intermittent due to incorrect radar operator techniques and an inoperable backup commercial radar system. USS Lake Champlain, over a series of maneuvers to remain in their assigned position relative to the aircraft carrier, did not follow standard procedures for lookouts, for communications between the Bridge and CIC, and for maneuvering requirements for stand-on versus give way vessels.

At 1145, USS Lake Champlain reversed its own course in front of the fishing vessel. Upon recognizing the possibility of collision, the OOD initially and improperly delayed maneuvering. At 1150, the OOD ordered right full rudder and engines to maximum speed (which was limited by some approved maintenance in progress). The OOD reassessed and ordered left full rudder (in an attempt to turn away from the fishing vessel) - these orders were carried out, and eventually turned left with available power. The fishing vessel did not maneuver, and struck USS Lake Champlain amidships on the port beam at 1151. Due to the small size of the fishing vessel, damage to both ships was relatively minor. This critique of USS Lake Champlain does not imply that Nam Yang mistakes and deficiencies were not contributing causal factors in the collision.

3.5 USS Antietam (CG 54) Grounding

On 31 January 2017, USS Antietam moved from her Yokosuka base to an anchorage in Tokyo Bay to take on supplies before a planned transit to conduct local area training. The navigation plan and brief noted the prevailing environmental conditions (high wind and current) but did not account for them during the approach to anchorage. After maneuvering to avoid shipping, USS Antietam turned to their anchorage using a different approach course than planned. Wind and current pushed USS Antietam south of the intended anchorage point, toward the nearest charted shoal. USS Antietam was 114 yards away from the planned anchorage point when the order to

“let go the anchor” was given. However, the CO believed the ship was only 50-75 yards away from the planned anchorage.

The dropping of the anchor was delayed because a retaining pin had been inserted backwards, making it difficult for deck personnel to remove it. When the anchor was finally released, the ship used less than half the amount of chain required to hold the ship in place under that day’s conditions. Recognizing continued wind-induced drift toward the shoal, the CO decided to bring up the anchor and reposition to the planned anchorage point. Internal miscommunication delayed anchor retrieval. As USS Antietam continued to drift toward the shoal, the CO delayed adding power or maneuvering into the wind until the anchor was retrieved, believing the greatest risk was damaging the ship’s SONAR dome by increasing speed while the anchor was underfoot. Once the anchor was retrieved and as power was added, the blades of both propellers struck bottom.

The grounding was a result of the Bridge watchteam’s failure to counter USS Antietam’s movement towards shoal water, poor seamanship while anchoring, leadership’s delayed response when steering into danger, and the watchteam’s inability to provide forceful backup in an extremis situation.

3.6 Analysis of Past Incidents

There are commonalities between the grounding and collisions that occurred this year, and several groundings, allisions, and collisions that occurred in the previous ten years. Past mishaps also considered included:

- 06 Oct 2014, USS Tortuga (LSD 46) allided with a buoy at the entrance to Chesapeake Bay while inbound to anchorage.
- 12 Feb 2014, USS Taylor (FFG 56) grounded in a harbor while pulling into port in Samsun, Turkey.
- 17 Jan 2013, USS Guardian (MCM 5) grounded on a reef in the Philippines.
- 12 Aug 2012, USS Porter (DDG 78) collided with a tanker near the Strait of Hormuz and sustained major hull damage above the waterline.
- 16 May 2012, USS Essex (LHD 2) collided with a fleet replenishment oiler while conducting an approach alongside the oiler for underway replenishment.

- 21 Jun 2011, USS Emory S. Land (AS 39) allided with a channel buoy after experiencing a loss of rudder control while heading into Bahrain.
- 05 Feb 2009, USS Port Royal (CG 73) grounded off the coast of Oahu, HI, while off-loading personnel into a small boat.
- 19 Sep 2007 USS Halyburton (FFG 40) sustained damage to the sonar dome when dropping anchor off the coast of Central America.

This review considered the factors present in the above collisions, allisions and groundings from 2007-2016 in order to build an awareness of the possible common factors that may have existed during past events that perhaps also existed during the four mishaps in 2017.

3.6.1 Common Causal and Contributing Factors

Non-compliance with safe navigational practices (fundamentals). In each of the four mishaps, the ships failed to take sufficient action. Multiple watchstations failed to comply with safe navigational practices and prescribed U.S Navy maneuvering and communications requirements. These failures were a causal factor to the chain of errors that resulted in these incidents.

Incorrect action in extremis (fundamentals). Once confronted with an extreme situation, each of the four ships delayed action, to include sounding alarms, signaling to the others ship, or warning the crew. All four ships failed to take action in ample time to avoid danger. Incorrect actions in extremis were a contributing factor to the chain of errors that resulted in the incident.

Substandard proficiency of Bridge and CIC watchstanders (fundamentals). In each of the four mishaps, the qualification of individuals for specific watchstations did not translate to proficiency to safely execute the mission. In USS John S. McCain, three key mishap watchstanders on the Bridge were temporarily assigned from another ship and had been qualified without adequate training on equipment differences between the two ships. In all four mishaps there was a gap in watchstander training, their experience, and/or their proficiency, and their ability to conduct the tasks they were assigned to perform. Beyond initial qualification and certification, the Bridge and CIC

watchstanders in each of the four incidents failed to respond to degraded conditions, and did not take associated controlling actions when approaching situations of extremis.

Substandard risk management and planning (operational safety, assessment).

In each of the four mishaps, the U.S. Navy ships involved failed to take into account relevant planning considerations such as weather, background lighting, hazards to navigation, traffic separation schemes, patterns and density of nearby shipping, and the capabilities of their own people and equipment. Three of the mishaps occurred during or shortly after transitions from one operation to another: USS Antietam was transitioning from underway to anchoring, USS Fitzgerald was moving from training evolutions to operational tasking, and USS John S. McCain was entering a busy TSS and preparing to enter port. Flawed planning was a contributing factor to the chain of errors that resulted in the incident.

Substandard Bridge and CIC coordination (teamwork). In each of the four incidents the TAO, Surface Warfare Console operator (SUWC), Shipping Officer and other CIC watchstanders did not perform their duties as primary advisors to the OOD for the safe navigation of the ship as required by Commanding Officer's Standing Orders and higher level instructions. CIC did not use readily available tools or information such as AIS, radar, correlated link tracks, or lookout reports, to build situational awareness. CIC watchstanders also failed to translate that information into action or recommendations to avoid grounding or collision. None of the Bridge watchstanders (e.g., OOD, JOOD, CONN) requested information from CIC to confirm position and course of nearby shipping, estimated CPAs, and agreement with recommended course maneuvers. Inadequate teamwork was a contributing factor to the chain of errors that resulted in these incidents.

Substandard CIC performance (fundamentals). Each of the four incidents involved unsatisfactory performance of the enlisted and officers on watch in CIC. Basic watchstanding fundamentals were not applied. For example, CIC Surface watchstanders did not conduct manual maneuvering boards (MOBOARD) or subsequently make recommendations to the Bridge to assist with safe contact avoidance. In addition, the senior OSs and the officers on watch in CIC failed to

observe and correct watchstander performance standards. Substandard CIC officer and enlisted (OS) performance was a contributing factor to the chain of errors that resulted in the incident.

Inadequate use and understanding of technology (fundamentals). In each of the four mishaps, watchstanders did not demonstrate proficiency in their abilities to use all resources available on the Bridge to gain situational awareness about their surroundings. For example, RADAR operators consistently failed to use the correct range scale or tune the RADAR to the appropriate settings based on the environmental conditions. In addition, navigation teams improperly interpreted information displayed on VMS; and did not use AIS to correlate information from other sources. Additionally, watchstanders did not have a complete understanding of their ship's integrated navigation systems, which gave effect to a false reliance on configurations that were perceived to work more efficiently.

Practice of not using AIS (operational safety, assessment). In each of the three collisions, the U.S. Navy ships involved had an AIS receiver and transmitter, but maintained their AIS in receive mode only. This removed one of the primary awareness and collision avoidance tools used on board most commercial vessels around the world. Further, they generally failed to use AIS information to improve their situational awareness. Inadequate use of AIS was a contributing factor to the chain of errors that resulted in the incident.

Substandard use of lookouts (fundamentals, operational safety). With the exception of USS Antietam's grounding, all mishaps involved unsatisfactory performance by lookouts, including the Bridge watch officers that also serve as lookouts. In each collision, one or more of those with lookout responsibilities did not report the closing contact and did not determine whether a constant bearing/decreasing range situation existed using tools such as MOBOARDs, alidades, or bearing circles. Lookout performance was a contributing factor to the chain of errors that resulted in the incident.

Watchbill Execution (culture). In each of the four mishaps, some of the personnel on watch at the time of the incident, or shortly before, were not on the

approved watchbill, and some of the personnel were not at their assigned watchstations. For example, the anchor windlass operator on USS Antietam was replaced with a different watchstander without approval; just before the USS Lake Champlain collided with Nam Yang, two junior OSs relieved four more senior OSs on the Surface Watch Station (SWS) so the more senior OSs could take a meal break; and on USS Fitzgerald, the SUWC departed for a restroom break without first obtaining a relief, and returned minutes prior to the collision. In each case, this was not the first time such substitutions were made without the required formal command permission. Poor watchbill management was a contributing factor to the chain of errors that resulted in the incident.

Poor logkeeping (fundamentals). In every mishap, Bridge and CIC watchstanders failed to keep proper navigation, position and surface contact logs. There was a lack of required entries, inconsistent times noted on entries, non-standard entries or phraseology customary to the service, lack of formal review, and significant numbers of missing logs, particularly missing surface contact logs. Poor log taking was a contributing factor to the chain of errors that resulted in the incident.

Ineffective shipboard training programs (operational safety, assessment). In each of the four incidents, there was inadequate training on the *Nautical Rules* for officers and watchstanders. In USS John S. McCain three key mishap watchstanders were temporarily assigned from another ship and had been qualified without training on equipment differences between the two ships. Training programs on these ships also contained training not relevant to upcoming operations; unapproved training plans; lack of records of attendance at training; lack of makeup training; and leadership was often not present at training. Training was a contributing factor to the chain of errors that resulted in the incident.

Inadequate fatigue management (culture). Fatigue was evaluated as a contributing factor in the USS Fitzgerald and USS John S. McCain collisions. Based on the reported sleep of the watchstanders at the time of the mishap, and referencing the validated expert data on deployed U.S. Navy crew performance when fatigued, USS Antietam watchstanders, including the navigator and the OOD, experienced the effects

of fatigue as they transitioned from an ashore watch rotation to an at-sea watch rotation. In the case of USS Lake Champlain, while the ship was using a circadian watchbill, it did not support that watchbill with an effective ship's routine, necessitating relief for meals at critical times leading up to the mishap.

3.6.2 Additional Important Factors

Lack of supporting documentation on ship's steering systems (operational safety). Watchstanders on USS John S. McCain did not have the training or knowledge on the modes of operation of the Integrated Bridge and Navigation System, particularly relating to the modes of operation for the ship's steering controls. They unknowingly transferred control of steering away from the Helmsman while shifting modes of operation. The designed responses of the IBNS when shifting modes also creates known vulnerabilities that have not been clearly communicated to the operators on ships with these systems.

Environment (operational safety, assessment). The environmental conditions present in each incident were manageable with proper Operational Risk Management (ORM), which henceforth in this report will be covered under operational safety. With the slight exception of the environmental conditions leading up to the USS John S. McCain mishap, which included mostly cloudy skies with isolated thunderstorms and moonlit illumination of less than one percent, the visibility during these incidents was unrestricted, seas were calm, and winds were moderate yet average for the regional climate. By all accounts, the ambient environment surrounding each of these events posed no significant challenges, nor did it presage the mishaps that would later occur. In only one mishap, that of the USS Antietam's grounding was weather (winds) a direct causal factor.

Routine operations (operational safety, assessment). Three of four mishaps involved ships that were independent deployers, and occurred during standard Bridge and CIC team evolutions common to all Navy ships. Except in the case of USS Lake Champlain, which was maneuvering to take a new station relative to the aircraft carrier when it collided with Nam Yang, there were no external warfare or defense obligations

that pressurized these situations. Each of these evolutions involved some risk, but each had been previously accomplished by the same crew with safe and effective outcomes.

Certification in Navigation and Seamanship (fundamentals, teamwork). All four U.S. Navy ships passed their navigation certifications. Each had successfully passed a navigation check ride by their ISIC, though in the case of USS Antietam and USS Lake Champlain, the certification had been accomplished by the Afloat Training Group (ATG) on behalf of their ISIC due to their ISIC not having qualified representatives available to conduct the assessment. Though qualified, the mishaps indicate the teams onboard these four ships were not proficient.

Positive control by the Commanding Officer (fundamentals, operational safety). In two of the four incidents the CO was on the Bridge at the time of the mishap. There was a lack of formality in the COs taking the conn while directing specific action, coupled with a lack of formal declaration that they had done so by the OOD led to confusion and delays in executing critical ship control actions by the OOD, Conning Officer and Helmsmen. The CO was not on the Bridge at the time of the USS Fitzgerald's collision with ACX CRYSTAL and USS Lake Champlain's collision with Nam Yang. In each case, the OODs did not call the CO to the Bridge, or the CO's representative in the CO's absence in a situation when they were required to do so by the Commanding Officer's Standing Orders.

3.7 Summary Findings

Findings were developed through examination of the significant surface mishaps above, field observation, interviews, and focus group discussions at various echelon levels from individual units to the Fleet Commander. In addition, the Review Team examined source documentation defining requirements for and execution of force generation and force employment models, as well as training curricula and equipment design criteria and utilization and a variety of primary references from industry and academia. The Review Team identified the gaps in doctrine, organization, training, material, leadership and education, personnel, and facilities that point to actions needed to improve in the areas of **fundamentals, teamwork, operational safety, assessment,**

and **culture**. Each of the findings below is discussed in detail in chapters four through eight.

3.7.1 Fundamentals

- The training continuum for Surface Warfare Officers (and candidates), Quartermasters, and Operational Specialists does not provide sufficient seamanship and navigation knowledge in advance of milestone assignments. (Sections 4.2.1, 4.2.2, 4.2.3)
- The individual qualification proficiency of Surface Warfare Officers is not periodically assessed against objective qualification standards or in high traffic, emergency or extremis situations. (Section 4.2.2)
- Unit seamanship and navigation training, assessments, and certifications do not adequately test or measure performance in high traffic, emergency, or extremis conditions. (Section 5.2)

3.7.2 Teamwork

- Unit seamanship and navigation training, assessment, and certifications do not adequately test or measure total Bridge and Combat Information Center team performance and effectiveness. (Section 5.2)
- Navigation and Seamanship Shiphandling Training (NSST) facilities do not adequately train the unique seamanship and navigation requirements for Navy Bridge and Combat Information Center teams. (Section 5.2)
- The watchstation requirements for proper surface contact management have not been reevaluated and established for the restoration of manning on surface ships after the “optimal manning” era. (Section 7.2.2)

3.7.3 Operational Safety

- Administrative and operational headquarters processes inadequately identified, communicated, and mitigated operational risks for ships based in Japan. (Section 6.2.2)
- Mishap units inadequately identified, communicated, and mitigated readiness risks within their units for the assigned tasking. (Sections 6.2.2 and 8.2.1)
- Increasing operational tempo and longer maintenance periods reduced the amount of time for Yokosuka-based ships to train. (Sections 6.2.1 and 6.2.2)

- There is insufficient administrative organizational oversight for the training and certification of Yokosuka-based ships. (Section 6.2.1 and 6.2.2)
- The demand for ready and certified ships to support operations in the Western Pacific exceeds the quantity that can be generated from Japan-based ships with adequate training and maintenance. (Sections 6.2.1 and 6.2.2)

3.7.4 Assessment

- The RAMP process did not adequately address or mitigate operational and training risk for Yokosuka-based ships. (Sections 6.2.1 and 6.2.2)
- Navy technical authority (NAVSEA) and type commander (COMNAVSURFOR) did not provide sufficient guidance on how to man, train, qualify, and operate modernized surface ship Bridge systems. (Section 7.2)
- Outdated modernization and acquisition design guidance has led to delivery of safety-critical Bridge equipment without effective human machine interface review. (Sections 7.2.2 and 7.2.3)
- The high number of inspections, certifications, assessments, and visits by external organizations create a burden on ships' crews and do not provide an objective validation of crew proficiency and self-sufficiency. (Section 8.2.1)

3.7.5 Culture

- The surface force requires an improved assessment process that utilizes objective data on performance, including near miss data, to detect and reverse organizational drift and institutionalize improvements. (Sections 8.2.1 and 8.2.4)
- The surface community does not have a comprehensive fatigue and endurance management plan to implement fatigue recovery standards and to codify a circadian watch and ship routine. (Section 8.2.2)
- The surface force does not have adequate training at all levels on human performance factors including fatigue, diet, and stress management. (Section 8.2.3)

4. INDIVIDUAL TRAINING

4.1 Introduction

Seamanship and navigation are hallmarks of the naval profession. Seamanship is the skill to operate, navigate and handle a ship at sea. Navigation is the process of planning, recording, and controlling the movement of a vessel from one place to another on the sea. Developing seamanship and navigation skills requires a solid foundation of mathematics, geometry, physics, oceanography and meteorology, as well as an understanding of the forces that affect a ship's movement on water. Becoming proficient in these fundamentals takes education and practice. Naval professionals develop practical experience by applying what they learn in the classroom with the tasks they perform at sea. Over time, they become proficient in gaging weather and ocean currents, using RADARs, alidades, and bearing circles, and doing so through repetition in a wide variety of routine and challenging environments.

Part of safe navigation at sea involves understanding and applying the navigation rules to be followed by vessels at sea to prevent collisions. These rules were developed over many years and are based upon conventions established by maritime nations. The introduction of powered propulsion systems and increases in international maritime trade necessitated the codification of these traditions and informal rules. The *Nautical Rules* are defined by the International Regulations for Preventing Collisions at Sea (COLREGS) published by the International Maritime Organization (IMO), and remain an outgrowth of the same informal rules and customs that naval professionals have followed for over a century. In other words, a U.S. Sailor in the 1940s would have largely been subject to the same general regulations designed to prevent collisions at sea as would a Sailor operating a modern U.S. warship today.

These *Rules* have stood the test of time, and are buoyed from centuries of maritime custom, and learned through hundreds of accidents at sea worldwide in order to make passage on the seas safer and more efficient. The necessity for such a standard for safety is even greater today. In the last 25 years alone, the amount of maritime traffic on the sea has increased by 400 percent, demanding even more

attention to adherence to the *Rules* and the customs of good seamanship and safe navigation.

Because risks are high in the maritime environment, there are widely accepted standards for safe seamanship and navigation. The International Maritime Organization (IMO) prescribes standards to safely and efficiently conduct commerce on the seas and prevent damage to the environment in accordance with international maritime law. In the U.S., the International Convention on Standards of Training, Certification and Watchkeeping (STCW) for Seafarers, standardizes the skills and foundational knowledge a maritime professional must have in seamanship and navigation, such as taking electronic fixes, celestial navigation, plotting, and voyage planning; and use of equipment such as AIS, RADAR, echo sounders (fathometers), global positioning system devices, steering gear, and weather measurement tools; as well as understanding and application of the *Nautical Rules*, identifying shapes, sound signals, lights and safe maneuvering.

Civilian maritime professionals are required to demonstrate that they have the knowledge and skills to be able to do all these things before advancing to the next level of the merchant marine industry. Many aspiring and current merchant marine professionals have some difficulty navigating the U.S. Coast Guard regulations, which enforce the STCW standards, but there are programs and individual courses to facilitate their training. Some programs include courses for those already in the maritime profession to provide education and application through ship simulators that facilitate building and assessing the skills necessary to meet regulatory and industry demand.

One example of this training can be found at the Maritime Institute of Technology and Advanced Studies (MITAGS), which developed a program to objectively assess civilian seamanship and navigation skills and provide recommendations for focused training and improvement. This program (the Navigation Skills Assessment Program (NSAP)) assesses the performance of individuals in a one or two day scenario to measure performance in five areas: ship handling, communications, Bridge equipment use, Bridge Resource Management (BRM) and application of the *Nautical Rules*. BRM is the process by which Bridge watch officers make use of all available human, equipment and information resources to safely and effectively navigate a ship.

In order to meet the Navy's missions, surface forces must, at a minimum, perform in all five of the above areas for safe and effective seamanship and navigation. The U.S. Navy's fundamental purpose is to control the sea at the time and place necessary to accomplish its objectives in war. To do this, the Navy maintains, trains and equips combat ready naval forces capable of winning wars, deterring aggression and maintaining freedom of the seas. Surface warships are designed, manned, trained and equipped for this purpose. They are less detectable by RADAR, and their systems are designed to be less susceptible to an adversary's intelligence collections, anti-ship missiles, and torpedoes to make themselves harder for an adversary to find, and harder for an adversary to kill. Still, the surface force must safely operate across the globe and through all manners of difficult situations

While the STCW standards are intended as a regulatory reference of fundamental proficiencies required of civilian mariners, U.S. Navy Surface Warfare Officers (SWO) must be capable of demonstrating seamanship and navigation competence in more stressing and challenging operating environments, from benign situations in which their warship is able to use all available IMO/SCTW resources and tools, to much more complex environments that account for a warship's unique characteristics and operations. In short, the Navy's mission demands that the surface force must have the knowledge and skills to navigate safely and effectively without the use of sensors, to include electronic navigation, RADAR and AIS when it is required.

Further, the technology used on U.S. Navy warships to lower detection from RADAR means warships must be particularly prepared to react to routine and emergency situations at sea when risk of collision may exist. While specific technology improvements such as reduction in RADAR detectability of a U.S. warship's external hull has lessened their own vulnerability to an adversary, the second order effect is that a warship that is more difficult to detect on RADAR by commercially configured merchant vessels may lessen the time, distance or understanding for which ample and safe actions can be taken to avoid collision. This underscores the need for close coordination between the Bridge and CIC.

The need for safe seamanship and navigation in order to carry out the ship's principal purpose in warfighting drives a watch organization and equipment

configuration that goes beyond the IMO standards prescribed for the maritime industry. A warship's CIC possesses the capability to collect, organize and display information to decision makers who direct, control and coordinate individual ship and multiple ship actions. CIC is the ship's nerve center, where RADAR and communications are combined to coordinate the warfighting mission. In the course of carrying out naval missions and tasks, CIC also generates information that is critical to the safe navigation of a ship.

To navigate a warship safely and effectively, the Commanding Officer must ensure Bridge and CIC personnel conduct prudent voyage planning carefully, anticipate dangerous conditions, and combine their collective skills to effectively use the methods and techniques best suited to their ship, its equipment, and the conditions at hand. Warfighting capabilities necessary to gain and maintain sea-control through the employment of combat power may be distributed over vast distances, multiple domains, and a wide array of platforms. While other seagoing professions must be proficient in seamanship and navigation, in the Navy these skills are also needed to establish, anticipate and react to conditions the ship might encounter both in peace and in combat.

The causal factors in these four mishaps are linked directly to a failure to take sufficient action in accordance with the rules of good seamanship. In addition, the ships' Bridge and CIC personnel did not use readily available tools or information such as AIS, RADAR, correlated link tracks, or lookout reports, to help build situational awareness. Bridge and CIC watchstanders also failed to translate that information into action or recommendations to avoid grounding or collision. As a result, the Review Team identified a number of findings that made improvements in the development, training and assessment of seamanship and navigation skills for Navy personnel involved in the safe navigation of U.S. Navy vessels critically important.

4.2 Findings

The Surface Warfare Officer community consists of nearly 9,000 officers stationed in 10 homeports throughout the world, and assigned to a variety of ship types such as Aircraft Carriers, Destroyers, Cruisers, Mine Countermeasure ships, Littoral Combat Ships, and Amphibious ships. In recent years, SWO career development

placed greater emphasis on breadth of experience in a broad variety of professional competencies than on reinforcing superior seamanship in navigation. Additionally, the Review Team found that Surface Warfare Officer candidate training is too dependent upon on the job training (OJT). Further, enlisted rating training for QM, OS and Electronic Technicians (ET) is overly dependent in OJT as well. The Review Team also found that throughout their career path, the simulated training SWOs receive does not include a rigorous assessment of seamanship and navigation knowledge and skills, including in emergency and extremis scenarios, in preparation for their next milestone assignment (i.e., Conning Officer, OOD; TAO, Commanding Officer).

4.2.1 Officer Training

Surface Warfare Officer candidates receive their first dedicated period of formal training before or shortly after reporting to their first ship, depending on classroom availability. Currently, initial formal training for SWO candidates consists of a nine week course taught in Norfolk or San Diego early in an officer's career with specific focus in the development of individual skill sets and knowledge in a number of topics, including navigation and seamanship, engineering, damage control, maritime warfare and leadership. Seamanship and navigation instruction includes *Nautical Rules* instruction and examination, and simulator time focused on the development of an individual's basic skills in handling a ship under power. A five week course is taught at the conclusion of a SWO candidate's first assignment at sea, totaling 14-weeks of a combined initial accession program.

During this training, SWO candidates receive instruction that is based on the Surface Warfare Officer Personnel Qualification Standards (PQS). All watchstations that are listed on the ship's watchbill are required to use PQS for qualification. PQS delineates a list of minimum knowledge, skills, and abilities that an individual must demonstrate before standing watches or performing other specific duties, and it is divided into distinct parts: fundamentals, which include the basic knowledge that can be learned through lectures and OJT such as understanding definitions and describing basic naval customs and practices; systems, which include understanding the operating parameters of systems associated with the watchstation, such as the functions of fire

pumps, Bridge equipment, anchoring systems, or combat systems equipment; and actions that must be demonstrated for qualification, such as mooring to a buoy, towing operations, underway replenishment, or getting underway and mooring to a pier.

All three levels of the PQS for a watchstation provide the foundational work necessary for the safe, secure, and proper operation of a ship. Commanding Officers are authorized to tailor PQS to best suit their ship and equipment. In this way, the training programs on each ship and PQS are fundamentally linked. The OJT that qualified watchstanders provide to under instruction watchstanders is tied directly to the tasks that an individual is required to demonstrate.

The Review Team found that the current SWOS Basic Division Officer Course (BDOC) teaches about half of the required fundamentals and systems theory included in the Surface Warfare Officer Personnel Qualification System (PQS). This is purely a function of the length of the course. The remaining fundamentals and understanding of systems associated with their ships, as well as the watchstation demonstrations that are required by PQS for qualifying, is the responsibility of the ship's training programs to meet their unique requirements. The classroom training provides standardized lessons in the form of lectures and activities to support the OJT that SWO candidates receive on their ships as they work through PQS to describe and demonstrate tasks before qualifying.

The first major Bridge watchstation that a new SWO candidate stands is Conning Officer, yet the individual is not arriving to the ship with the foundational knowledge and skills to perform in the duty. In fact, Conning Officers, Junior Officers of the Deck, and prospective Officers of the Deck (OOD) receive the majority of their foundational training through OJT. The quality of that OJT is largely dependent upon the ship, its Commanding Officer, and the level of knowledge of the individuals assigned to that ship. The result is the development of our SWO corps lacks objective and consistent qualifying standards and knowledge.

This review found that in each of the four mishaps, the ships failed to take sufficient action. Multiple watchstations failed to properly apply safe navigation and seamanship practices was causal to the chain of errors that resulted in these incidents. Further, in each of the four incidents the TAO, and multiple watchstations in CIC failed

in the performance of their duties as primary advisors to the OOD for the safe navigation of the ship, and failed to use readily available tools or information such as AIS, radar, correlated link tracks, or lookout reports, as required by Commanding Officer's Standing Orders and higher level instructions.

The failure of qualified, trained and certified personnel and watch teams to execute their duties safely and professionally, while unacceptable, is not uncommon. For example, the Review Team observed instruction at MITAGS, which has performed over 1,600 assessments on merchant marine professionals using the NSAP model described above, and noted a number of characteristics of poor seamanship and navigation skills in the merchant marine community. As examples: 36 percent of individuals turned to port in extremis; 35 percent were unable to properly tune their navigation RADAR; 30 percent did not make proper use of electronic chart system safety features; and, overall, there was an overreliance on electronic chart systems as a single source of navigation information, as well as a broader neglect of visual and RADAR equipment.

The Review Team found that SWO navigation and seamanship training, while incorporating improvements in schoolhouse training, lacks a comprehensive assessment of an officer's navigation and seamanship proficiency at each career milestone. The results of this are two-fold: first, the officer returns to a ship at each milestone having only minimal refresher training in *Nautical Rules* and BRM, and second, that officer has not been objectively evaluated in the application of these skills in routine, emergency or extremis scenarios to determine the adequacy of the training the officer received or the degree to which the officer has learned or relearned the fundamentals provided during training. Most importantly, the Commanding Officers that receive these officers aboard for assignment do not know what to expect of their officers since they have received no standardized, objective evaluation.

4.2.2 Officer Career Path

Over the past ten years, the SWO community has accessed and assigned new SWO candidates above the billeted needs on surface ships, taking into account officer retention in order to meet sufficient numbers of Department Heads required to man the

force. As a result, more SWO candidates must share opportunities to conduct the necessary tasks and evolutions necessary to qualify for a particular watchstation. Considering the number of first tour division officers (SWO candidates), the pattern of arrival from initial training, the number of prerequisites required for SWO qualification (such as damage control, maintenance management, and CIC Watch Officer) and the requirement to complete the surface warfare qualification within 18-months, there is little time to build experience and demonstrate proficiency. The policies and practices related to first tour division officer assignment and SWO qualification force SWO candidates to place greater value on qualification rather than experience and proficiency.

In addition, the Review Team found that foundational standards for professional core competencies are not consistent among all accession sources. The team found that the U.S. Naval Academy and Naval Service Training Command have jointly promulgated an Officer Professional Core Competencies (PCC) manual to delineate the knowledge, skills and abilities requirements for basic trained naval officers to possess, but the competencies actually taught are not consistent across all accession sources.

The current SWO career path specifies two division officer tours, each two years in length. Every SWO candidate must complete their SWO qualification during their first tour, which includes qualification as OOD. The experience gained during these two division officer assignments is highly dependent upon ship's operational schedule. If assigned to a U.S. port a new SWO candidate might see a ship tour dominated by shipyard maintenance, training and certification, or operational deployment, all to a varying degree. Forward deployed ships operate under different operating cycles and notionally operate with a higher operating tempo. Two year division officer assignments are not synchronized to these operating cycles. As a result, individual experience varies widely depending upon when a SWO candidate joins the ship. Given the large number of first tour division officers and the variances in operational experience, these officers may complete their initial sea duty assignment having completed the minimum tasks and experience to complete the Surface Warfare Officer qualification. In other words, they transfer to a second sea tour just as they are poised to gain proficiency and experience following qualification in their first ship

Further, there is no standard for the quality or quantity of time spent as a watchstander, nor the tasks performed on watch. Civilian navigation and seamanship standards for qualification include a time component that is tracked and must be presented as part of the certification and qualification process. In 2015, the surface force instituted a requirement that three of a SWO's first four sea tours must be assignments to commissioned ships in an effort to increase the operating experience for SWOs. However, SWOs do not define or track currency or proficiency throughout an officer's career, to include a basic accounting for number of days at sea and number of qualified watches at sea.

Following these first two sea duty assignments and generally after a tour ashore, SWOs selected for Department Head receive 27-weeks of instruction at the Department Head course prior to their next and more senior assignment aboard ship. The training during this period of instruction covers a broad array of topics, but is primarily focused on maritime warfare and developing officers' tactical proficiency to qualify as Tactical Action Officers. As part of this course officers receive instruction in tactics, engineering, damage control, leadership, and navigation and seamanship, which includes *Nautical Rules* instruction and a practical assessment in shiphandling in a Bridge simulator. They also receive the USCG certified BRM course, but do not receive simulated training on emergency or extremis situations.

Prior to assignment as an Executive Officer (XO) or Commanding Officer (CO), officers attend a ten week Surface Commanders Course. The course opens with engineering and damage control material, and then continues with maritime warfare, command management programs, the Senior Officer Ship Maintenance and Repair Course (SOSMRC), seamanship and navigation, and leadership instruction. During navigation instruction, prospective XOs receive the USCG-certified BRM course, *Nautical Rules* instruction and examination, and complete a shiphandling refresher training and receive a practical shiphandling assessment. Officers who "fleet up" from Executive Officer to Commanding Officer aboard the same ship return to Newport for a two week period before assuming command. The training conducted during this two week period is specifically tailored to the projected operational schedule for the ship during the officer's command tour, with input from the ship's Immediate Superior in

Command. The Review Team found that seamanship and navigation may be a part of this process, but is not mandatory.

Prior to returning to sea as a Major Commander (paygrade O-6), officers attend a three week Major Commanders Course in Newport, Rhode Island. The course includes a refresher practical exercise in BRM, *Nautical Rules* instruction and examination, as well as a shiphandling assessment. The Review Team found that this course does not include instruction on the role of an Immediate Superior in Command (ISIC) in assessing the ship's navigation skills during the ISIC navigation check ride, or methods to provide appropriate oversight to shipboard navigation and seamanship.

4.2.3 Enlisted Training

Quartermasters (QMs) and Operations Specialists (OSs) are the primary enlisted members responsible for the support of navigation tasks on Navy ships. QMs are responsible for maintaining the navigation plot on the Bridge and fixing the ships position, and OSs, among other duties, are responsible for performing RADAR plotting and surface contact management support to the Bridge watchteam. Another key member of the seamanship and navigation team is the Electronics Technician (ET). The ET provides the maintenance support for Bridge and CIC navigation equipment.

The QM training continuum consists of both schoolhouse training and OJT. Prior to 2015, formal QM training in the school house was limited. The apprentice-level course ("A" school) was not mandatory and there were no journeyman or masters-level courses. In 2015, A-school courses became mandatory, and they taught applicable sections of *Nautical Rules*, fundamentals of navigation aids, and other information needed to maintain a proper navigation plot. The *Nautical Rules* exam is based on a tailored, locally produced test bank that does not utilize the United States Coast Guard test bank. Plotting skills are first learned and tested on paper navigation charts, then on VMS. The VMS Operator Course for version 9 will be taught to all QM "A" school graduates starting in October 2017. Additionally, prior to 2013, Sailors that transitioned into the QM rating (vice joining the Navy with QM as an assigned rating), completely relied upon OJT in order to build their skills. As a result, existing junior Sailors that transitioned into the QM rating did not receive any initial training on navigation

fundamentals, relying entirely on OJT for their skill training. In October 2016, a QM Journeyman course was established in San Diego and Norfolk homeports. This course provides for the development of skills prior to a second sea duty assignment. Successful completion of this course results in awarding the 0203 NEC. The Review Team found that as a whole the QM Journeyman course has appropriate rigor, but needs improved emphasis on RADAR theory and operation and log keeping requirements.

Senior QMs were recently admitted to the Surface Navigator course in Newport, RI, which is also taught for all prospective Navigation Officers. Successful completion of the course results in the award of the 0202 NEC for enlisted members. This critical NEC is in high demand in the surface force. The QM attrition rate in this course currently stands at 45 percent. This five week course is the first time QM's are exposed to the same *Nautical Rules* instruction and examination process that SWOs receive, including the requirement to pass a 50-question test generated from the USCG *Nautical Rules* test bank. Basic navigation chart plotting fundamentals are also significant factors in the high QM attrition rate. This course is the capstone (final achievement) for the QM training continuum.

The Review Team also found that the OS rating does not have an established continuum of formal training for the rating, and relies too heavily on OJT. There is an apprentice course that teaches the required occupational standards, but without sufficient rigor in RADAR theory. There is no OS masters course, or school for mid-level Petty Officers. Given the degree of responsibilities these Sailors carry for supporting Bridge watchstanders in safe navigation, the absence of an OS continuum of training makes OJT the primary method these Sailors must use to develop their navigation plotting, RADAR operation and surface contact management skills.

The Review Team also found that level of knowledge of navigation systems maintenance in the surface force needs improvement. The apprentice school for ETs is focused on basic electrical theory and the development of occupational standards. The apprentice school does not address the depth of knowledge and skills needed to properly maintain complex electronic navigation systems on ships, specifically the Integrated Bridge Navigation System (IBNS), the Electronic Chart Display and

Information System (ECDIS), and Voyage Management System (VMS). These skills are developed in the ET Navigation Systems Maintenance Training course, which produces the critical skill defined in the Navy under the Navy's Enlisted Classification (NEC) 9617. This course was first introduced in October 2016. The Review Team found this course provides needed improvements to instruction on electronics systems maintenance.

The Review Team found that QMs and OSs have insufficient knowledge to properly use the tools provided for navigation and surface contact management to fulfill CIC's fundamental role in supporting safe and effective navigation. Just like the Conning Officer must arrive with a solid understanding of navigation and seamanship to effectively perform, QMs and OSs must also arrive at their command with solid foundation and skills in operating RADAR, AIS, ARPA and the duties of their watchstation. Further, the Review Team found there is no formal training on Aegis consoles provided to OSs for surface contact management on Aegis equipped ships. All Aegis console operator knowledge for OSs in CIC that stand the Surface Warfare Coordinator (SUWC) watchstation gain knowledge and qualify via OJT. The SUWC is a key watchstander in CIC that supports the Bridge in surface contact management and effective contact avoidance.

QM and OS schools do not teach the appropriate level of knowledge in operating and tuning surface search radars, and the OJT onboard ships is not meeting the need. OJT alone does not produce the required level of knowledge to build sufficiency as a foundation for these critical watchteam support qualifications; reductions in formal schools have contributed to an observed decline in the knowledge base across the surface force. The Review Team also found that training and examination for these watchstanders on the *Nautical Rules* during OJT is insufficient to deliver a consistent and appropriate understanding and application of the *Rules*.

4.3 Recommendations

4.3.1 Individual Training

- 1. Create an objective, standardized assessment program to periodically assess individual seamanship and navigation skills over the course of a Surface**

Warfare Officer's career. This process should be informed by the MITAGS Navigation Skills Assessment Program (NSAP) principles to assess Surface Warfare Officer seamanship and navigation skills at every career milestone, including an objective assessment by SWOS prior to initial qualification as Officer of the Deck. [NETC, 31Mar2018]

2. **Improve seamanship and navigation individual skills training for Surface Warfare Officer candidates, Surface Warfare Officers, Quartermasters and Operations Specialists.** This effort should include at a minimum updating the curricula (content and durations) for Surface Warfare Officers, Quartermasters, Operations Specialists, and Electronics Technicians, for all career milestones from new accession to major command (for officers) or master-level (for enlisted). [NETC, 31Mar2018]
3. **Improve Operational Risk Management training and education at all Surface Warfare Officer School milestone courses.** [NETC, 31Mar2018]
4. Provide additional fundamentals training for officers who qualified SWO without initial classroom training (e.g., SWOSDOC or B/ADOC) covering Automated RADAR Plotting Aid (ARPA), Electronic Chart Display and Information System (ECDIS), and Automatic Information System (AIS). [NETC/CNSF, 31Mar2018]
5. Update the Surface Warfare Officer Requirements Document to capture the metrics used to evaluate seamanship and navigation skills in Surface Warfare seamanship safety assessments. [CNSF, 31Mar2018]
6. Incorporate fatigue, crew endurance, and stress management into appropriate career milestone Surface Warfare Officer training and enlisted leadership courses. [NETC, 31Mar2018]
7. Evaluate use of Yard Patrol craft in all officer accession programs. The study should include the feasibility of expanding Yard Patrol craft use, and other training methods, so that every naval officer receives core competencies as articulated in the Officer Professional Core Competencies Manual. [USNA/NETC/CNSF, 30Sep2018]
8. Update Personnel Qualification Standards for Bridge and CIC watchstations including actions to address current navigation tools, surface search radars, ship control systems, and team performance related to navigation and contact management and avoidance. [NETC, 31Dec2017]

9. Revise the Surface Force Readiness Manual to define the Officer of the Deck requalification process and circumstances under which watchstanders requalify on their current platform due to configuration changes. [CNSF, 31Mar2018]

4.3.2 Officer Career Path

1. Align the number of SWO candidates assigned to ships with the billet requirements. [CNP, 31Mar2018]
2. Evaluate the SWO career path from accession to major command including the scope and timing of formal training, sea/shore assignments, and Executive Officer and Commanding Officer sequence and timing. This evaluation should also incorporate a process to ensure an appropriate talent distribution of SWO candidates to the fleet in their first sea duty assignment. [CNP, 30Sep2018]
3. Establish a single, longer division officer tour as the standard, with allowances for specific billet requirements. Emphasize that the focus of division officer tours should be building proficiency, especially in seamanship and navigation. [CNP, 31Mar2018]
4. Establish policy to define, maintain, and reestablish SWO currency (e.g., a Bridge log) that accounts for Surface Warfare Officer OOD, JOOD, and Conning Officer watchstations. [CNSF, 31Dec2017]

5. UNIT TRAINING

5.1 Introduction

Effective teams must be built on a solid understanding and execution of the fundamentals. Teams become proficient through frequent reinforcement, repetition and understanding of the importance of each individual's contribution, as well as the roles of their teammates, to the safe and effective accomplishment of the mission. As discussed in Chapter four, the surface force is required to be well versed in a variety of warfare missions as well as seamanship and navigation. The nature of military operations, and the unique ship handling and reduced detectability characteristics of warships puts a greater burden on its crew to safely navigate. As such, the cohesiveness of the Bridge and CIC team is the keystone for safe operations at sea.

Some of our most junior personnel are assigned to duties involving the safe navigation of the ship within the Bridge and CIC team. As such, they are relied upon to provide immediate, relevant input to our operations at sea. Given the importance of their contribution, OJT should be limited to honing their skill as a member of a team vice building their individual skills fundamentals. Watchstanders must arrive on their ship with a solid foundation for their seamanship and navigation duties including the use of equipment. After all, the Conning Officer is charged with driving the ship with careful consideration of the ship's engines, rudder, lines, ground tackle, as well as environmental conditions. Our QMs and OSs plot the ship's position, use sensors to detect shipping and must routinely report seamanship and navigation hazards to ensure the safety of the ship. The fundamental training they receive is the foundation on which successful ships execute their mission at sea.

In accordance with the Surface Force Readiness Manual (SFRM), and the Navigation Department Organization and Regulations Manual (NAVDORM), Navigation and Seamanship assessments and exercises should occur after maintenance periods and during the Basic Phase of a ship's training cycle. The first step in a ship's navigation certification is the Immediate Superior in Command (ISIC) navigation check ride. Typically held during sea trials, the ISIC check ride verifies ships leaving major maintenance availabilities are safe for basic navigation operations. Once a ship is in

the Basic Phase, Afloat Training Group (ATG) navigation training and certification exercises are conducted in a building block approach with a final certification exercise that qualifies the ship for unrestricted operations at sea.

The ATG is Commander Naval Surface Force's (CNSF's) executive agent for training and assessment. As part of the SFRM, ships perform ATG-monitored exercises to demonstrate readiness. Exercises are prescribed by CNSF in the Surface Force Exercise Manual (SFEM), and build from basic operations, to include demonstrating mobility and navigation, to more advanced operations involving warfighting. Certification in a mission area is granted by a ship completing all of the certification exercises (CE) for that mission over a specified period of time.

Three of the critical mission areas that comprise the full unit certification include Mobility Seamanship (MOB-S), Mobility Navigation (MOB-N) and Surface Warfare (SW). Each mission certification is designed to implement an incremental approach to certification throughout the various stages (1.1 through 1.4) of the certification. Specifically, phase 1.1 is designed to validate equipment required for the respective mission area. All equipment should be operational and maintained to standards prior to advancing to the next phase. During phase 1.2, ATG introduces and reviews core competencies which are further enhanced with hands on training during phase 1.3. Assuming the unit has demonstrated adequate knowledge in fundamentals and equipment utilization, with the recommendation of ATG, the unit will proceed to phase 1.4, the formal certification event. During the certification event, the unit will demonstrate specific tasks relevant to specific core competencies of the mission area. For example, MOB-S requires man overboard drills with shipboard and rigid hull inflatable boat (RHIB) recovery as well as safe and successful execution of mooring to a buoy, and MOB-N requires a precision anchorage. By design, simulator opportunities are interspersed throughout the training and certification process to allow more time to practice shipboard procedures, while enhancing their seamanship and navigation skills. Simulator training requirements, including hours needed in coursework and evolutions, are specified in the Navigation Seamanship and Shiphandling Training instruction.

During a Commanding Officer's (CO) tour, their ship is expected to conduct forty hours of Bridge Resource Management (BRM) training. Ships are required to send

three watch teams to BRM training to include three teams each consisting of an Officer of the Deck (OOD), a Conning Officer, and an Officer of the Deck under instruction. All classes will be attended by a senior observer (CO, XO, or Senior Watch Officer. Similarly, Special Evolutions Training (SET) is required every calendar year with 28 hours of instruction. Each ship is allocated an additional 32 SET hours per year for use at the CO's discretion. Basic Ship Handling is designed for newly commissioned and novice Bridge watchstanders, but can also be tailored for more experienced shiphandlers.

A fundamental tenet of the SFRM is to train the watchstander, watchteam, and maintainer with the goal of Sailors deploying at their peak readiness and properly prepared to overcome the challenges presented on deployment. The current structure of the SFEM in combination with the specific exercise grading criteria in place at ATGs are insufficient to accomplish that goal. The individual watchstanders that comprise the Bridge and CIC teams each serve a critical role in overall functionality of the unit. However, with the exception of low-visibility operations (where CIC maintains the surface picture for the Bridge), none of the mission area certification metrics for MOB-S, MOB-N and SW evaluate the Bridge and CIC team performance regarding coordinated surface contact management, and casualty control team processes, especially in complex, tactical, or rigorous emergency and in extremis scenarios.

5.2 Findings

All four ships involved in 2017 mishaps were certified in MOB-N, which was preceded by a successful ISIC navigation check ride. The Review Team found these assessments inadequate in validating the team performance between CICs and Bridges in predictable operational situations. Further, the ISIC navigation check ride evaluates scenarios that do not require observation of Bridge watchteams where the Commanding Officer and Executive Officer are not on the Bridge and only evaluates Restricted Waters Navigation and Low Visibility Piloting.

ISICs are not properly manned or qualified to effectively execute their responsibilities as prescribed in the NAVDORM. For example, there is no requirement for a senior QM assessor to be trained on the specific navigation, piloting and ship

control systems on the ship being observed. Similarly, Destroyer Squadrons do not currently have the NEC 0202, Assistant Navigator codified as a requirement for the QM billets on staff. There are similar mismatches in OS staff requirements to support navigation check rides. Of note, ensuring sufficient expertise exists in squadron staff becomes increasingly difficult with the numerous configurations of navigation equipment, RADAR sensor and ship control systems.

In addition to the manning shortfalls associated with the navigation check ride, the detailed navigation assessment checklist grading criteria is comprised of “yes” or “no” answers and consequently, does not provide in-depth guidance on how to use those grades to make the final assessment useful for the crew. Likewise, neither command leaders nor their composite teams are assessed for proficiency as part of the checklist. There are no criteria for proficiency with equipment (e.g., AIS, ARPA, ECDIS-N, and RADAR piloting). As discussed earlier, these are some of the fundamental tools that junior watchstanders must be able to utilize and extrapolate from in order to support the Bridge and CIC team synthesis.

In order for Yokosuka-based destroyers to maximize operational availability, the ISIC navigation check ride is conducted on the first day of sea trials and the navigation watchteam training and final navigation certification event is conducted at the end of the same underway. The Review Team found this process to be ineffective. As a corollary, three of the four ships involved in the four representative mishaps had recently completed major maintenance availabilities with truncated navigation training and certification (ISIC navigation) check rides.

There is insufficient formal training on the roles and responsibilities of CIC in safe navigation and contact management during the MOB-N certification. Each course is taught as a microcosm of the overall navigation and contact management process with no emphasis on teamwork, information dissemination, or effective communication. ATG’s MOB-N 1.2 training events are targeted solely at Quartermasters and there is no integration with CIC or other Bridge watchstanders (e.g., OODs). Additionally, contact management and avoidance is not included in the MOB-N curriculum.

The review found that the navigation and seamanship certification exercises used by ATG are not providing a critical validation of the true proficiency of Bridge and

CIC watch teams. ATG's navigation certification exercises, prescribed by the SFRM, do not place sufficient rigor on the knowledge, skills, and abilities of individual watches and teams. The certification exercises do not include contact management, Bridge casualty control scenarios, effective use of RADARs, or watchbill management. Additionally, navigation training presentations are not tailored to ships' individual navigation suites. Subsequently, a Bridge team can receive satisfactory grades even when the Bridge and CIC fail to work as an effective team, or a Bridge watch officer fails to demonstrate the required skills with maneuvering boards or the use of RADAR in open ocean navigation. Further, certification exercises are largely checklist-based and do not provide holistic assessments of watchteam effectiveness or readiness. This was evident in the USS Antietam mishap as the ship was certified in MOB-S at the time of the mishap.

The Review Team found that there is no venue away from a ship for Bridge and CIC teams to conduct navigation and surface track management exercises on ship's representative equipment. The existing shore-based Bridge trainers do not incorporate a CIC component, either by live interaction or by instructor role play. Specifically, Navigation, Seamanship, and Shiphandling Training (NSST) simulators and facilities do not have the capability or capacity to include CIC watchteams into navigation, contact management, and contact avoidance scenario training. While the simulators are effective for ship handling (driving) training, they do not currently have the capability to emulate or simulate the various ship control systems that are resident in the surface force. Thus it is not possible to run through evolutions or casualties relating to rudder and throttle control. Likewise, Surface Warfare Officer School (SWOS) Bridge simulators do not have a CIC component.

The Review Team found BRM and basic shiphandling course periodicity requirements do not ensure watchteams receive the training as part of a logical workup prior to operations. The course curriculum and lesson plans for each of the mandated courses are dated and need to be reviewed for currency and relevancy. None of the NSST-required courses require enlisted Bridge watch standers, and thus the actual crew members who stand watch as teams while the ship is underway do not benefit from this simulator. These simulators are capable tools but, by instruction, the mandated courses emphasize individual officer training vice team training. Further, this

training is not in all cases graded and is not used to inform officer watch qualifications. Additionally, the USCG certification for BRM training at fleet concentration area NSST sites was not included in conjunction with the award of a new contract.

The Review Team found that the RADAR Navigation Team Trainer is not updated and is not required for individuals that are on ECDIS on certified ships – all but approximately ten ships in service. The RADAR Navigation Team Trainer course includes Voyage Management System (VMS) instruction, classroom instruction and practical exercises in paper chart work, terrestrial and coastal navigation, celestial navigation, and navigation team exercises in a Bridge simulator, but there is no interplay or simulation of interaction with the CIC navigation team during these Bridge team trainers. Additionally, there is no mechanism for ATG to tailor training to the widely variable and fast-evolving navigation and ship control suites, especially in a tactical environment. As a result, there is no rigorous training for casualty control drills involving actual or perceived loss of steering or loss of throttle control.

While a review of grade-sheets used by ATG shows the SW exercises do not explicitly evaluate CIC-Bridge teamwork, the more tactically advanced demonstrations implicitly require some degree of CIC-Bridge teaming to be successful. However, in the four mishaps the ships were not certified in SW. The SW certification expiration lag time ranged from nine to seventeen months, which eliminated its usefulness in mitigating weaknesses inherent in the more fundamental MOB exercises.

A review of completed ATG MOB-N grade sheets for ships involved in these mishaps indicates an overreliance on checklists by ATG assessors and an inadequate assessment of the watchteams as a whole. As an example, each evolution conducted includes a specific score of effective interior communications between controlling stations. The ATG MOB-N assessment of USS Fitzgerald in February of 2017 included handwritten comments in most individual events pointing to problems with Bridge communications with other stations, but there were no summary comments highlighting that trend. Additionally, problems in taking timely and accurate fixes and bearings in a number of the exercises were not highlighted. The administrative reviews by the ATG team also identified a number of deficiencies in day-to-day performance of the crew. For example, they noted that crews spent insufficient time in NSST doing special

evolutions, standing orders and night orders were not reviewed, and there was a lack of compliance with requirements from a list of NAVDORM appendices. The ATG comments indicate they were corrected on the spot or were to be corrected in future training. While in aggregate these indicate a lack of rigor in ensuring current knowledge by watchstanders, and upholding basic standards of readiness for navigation, there were no references to these issues in the summary of comments provided in the ATG report.

5.3 Recommendations

1. **Improve current seamanship and navigation team training and certifications to include assessment in high shipping density, emergency and in extremis environments.** This action should include establishing the curriculum to evaluate Bridge and CIC teams' ability to respond to navigation and shiphandling scenarios in accordance with the *Nautical Rules* for non-standard and emergency situations, including in extremis. [NETC/CNSF, 31Mar2018]
2. **Improve shore-based Bridge trainers and add CIC functionality to team training facilities.** Establish the requirement to include all watchstations associated with safe navigation in team trainers and determine any facility modifications or upgrades necessary to accomplish the integrated training. Leverage outside expert organizations (e.g., NASA Langley Research Laboratory, Crew Systems and Aviation Branch) to independently assess and recommend improvements to the simulator training strategy. [CNSF/NETC/OPNAV, 31Mar2018]
3. **Integrate Bridge and CIC evaluations for unit level seamanship and navigation training in shore-based team trainers, and during at sea training and certifications events.** Commanding Officers shall be required to attend, and scenarios shall focus on high-density traffic transits. [CNSF/NETC, 31Mar2018]
4. Improve current seamanship (MOB-S) and navigation (MOB-N) team training and certifications to include assessment of Bridge-CIC team performance up to and including the Commanding Officer. [CNSF, 31Mar2018]
5. Recertify Bridge Resource Management training in the fleet concentration areas' Navigation Seamanship and Shiphandling Trainers to USCG standards. [NETC, 31Mar2018]
6. Implement a plan for all ISICs to evaluate the proficiency of the ships and crews to safely navigate in high-density traffic transits in the NSST as part of their ISIC

navigation check ride after extended maintenance and before deployment. [CNSF, 31Dec2017]

7. Revise the NAVDORM to establish the SUWC as the primary surface contact management and contact avoidance watch station in CIC and establish formal SUWC training. [CNSP/CNSL/CNAP/CNAL/NETC, 31Mar2018]

6. GENERATION AND EMPLOYMENT OF OPERATIONAL FORCES

6.1 Introduction

6.1.1 Force Generation

The Navy executes a rigorous process to prepare and certify warfighting units as ready for operational tasking. This process of force generation is executed through a cycle that provides time for maintenance of the ship, execution of appropriate crew training, validation of crew proficiency through a demanding certification process, and sustainment of readiness throughout a period of operational availability. Once certified and available for operations, the unit will be assigned tasking by the operational commander (called force employment). The execution of this force generation and force employment process must be balanced to ensure that the maintenance, training and certification efforts support and align with operations, operational plans and the long term readiness of the force.

The Optimized Fleet Response Plan (OFRP) is the dominant Navy force generation model that outlines a predictable cycle to maximize a ship's employability while preserving the appropriate time for maintenance, modernization and training. The OFRP's guiding principles are to align and synchronize all the processes that prepare units for deployment. This includes distribution of manpower to operational requirements; scheduling maintenance and modernization; improving the overall quality of work and life for personnel; and ensuring forces are deployed with the right capabilities, trained and certified to a single high-end standard, and equipped to meet the Navy's missions.

Based on the OFRP guiding principles, force generation for ships that are homeported in the U.S. involves a building block approach that consists of four major phases: maintenance (major shipyard repairs, upgrades and platform modernization), basic phase (core capability/skills achieved by individual units to Type Commander standards), integrated or advanced training (advanced capability/skills to build individual units and staffs into aggregated, coordinated strike groups certified by the Fleet commander) and a sustainment phase (deployment or sustainment readiness as

resourced), all accomplished in series. After completing unit certifications, the Commanding Officer must sustain the readiness of the ship using internal training processes. Each readiness cycle is 36-months, as outlined in Figure 6.1. All unit certifications reset at the beginning of the ship's maintenance phase, requiring a recertification within each cycle.

Figure 6.1. OFRP-based CONUS readiness generation model.

Months	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
CVN	Maintenance					Basic			Advanced			Int.	LV	Deployment								LV	Sustainment														
CRUDES	Maintenance					Basic			Advanced			Int.	LV	Deployment								LV	Sustainment														Maint

Forward-deployed naval forces execute a tailored force generation model that should follow the same principles as the OFRP but uses different cycle duration than in CONUS to align with the mission tasks to be executed.

The readiness generation model for ships forward-deployed to Japan (FDNF-J) is aligned with a 24-month cycle for mission area certifications as prescribed by the SFRM. During that 24-month cycle ships are in a continuous period of sustainment, treated as ready for operational tasking when they are not in depot-level maintenance and modernization. During this sustainment phase, routine maintenance and training, and certification when required, are scheduled in windows interwoven with operations. Added requirements in any area put stress on the system; for example, longer than planned maintenance periods can serve to reduce the time available for training and certification or limit the opportunity to service higher operational demand. The force generation process must balance these demands while ensuring the ships are maintained in a high state of readiness.

Figure 6.2: Japan-based readiness generation model.

Months	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
CRUDES	Maintenance						Sustainment																	

Included in the FDNF-J force generation model is a process to adjudicate any mission area certifications that expire but cannot be recertified because either (1) an operational demand supersedes the time needed to re-certify a particular mission area, or (2) a maintenance, training, or manning deficiency exists that prevents successful completion of a certification. These lapses in certification that cannot be quickly

regained should be rare; and in these circumstances, a Risk Assessment Mitigation Plan (RAMP) is produced by the ship to delineate the condition that prevents certification, the risks associated with operating without that certification, any actions (such as additional oversight or temporarily assigned personnel) to mitigate those risks, and a plan to complete the certification. The RAMP is the mechanism by which the unit Commanding Officer communicates the potential risks to his or her unit performance associated with expired mission area certifications, and the actions to be taken to mitigate those risks. Headquarters in the chain of command should then ensure an informed decision on unit employment is made. Rigorous execution of the RAMP process would result in appropriate risk mitigation measures to ensure a ship was ready for tasking.

The Review Team found that the increasing demand in the Western Pacific, driven by increased BMD and presence missions and increased dynamic tasking to support exercises and experimentation (further details provided in the Classified Annex, Appendix 9.10), exceeded the capacity that can be reasonably generated from Japan-based ships under their existing readiness generation model cycle. The time available for training was also impacted by maintenance periods extending beyond nominal durations due to an increased scope of work and number of ships based in Yokosuka. As a result of this increased demand and delays in maintenance execution training opportunities were reduced and completed warfare area certifications across FDNF-J declined from 93 percent in 2014 to 62 percent in 2016.

This data indicates the assumptions underpinning the Yokosuka-based ships force generation model, such as duration of maintenance periods, had changed to the point that the intended model could not be executed. Additionally, execution of the RAMP process for these expired certifications had become an administrative acknowledgement of the expired certifications without true evaluation of the associated risk or development of meaningful mitigating actions.

6.1.2 Force Employment

Upon completion of the force generation process, a unit is ready and available to the operational commander. Effective force employment requires that the capacity of

the force generation model be balanced with the mission requirements as defined, and prioritized, by higher authority (such as the Geographic Combatant Commander). Higher headquarters often must adjudicate shortfalls in forces available for mission requirements based on the priority provided, including an evaluation of additional capacity that may be available using CONUS-based forces. The Joint Staff's Global Force Management process is used to resolve these capacity shortages taking into consideration the priority of requirements across all combatant commander areas of responsibility.

Surface ships based outside the continental U.S. (OCONUS), particularly in Japan, are employed to support operational commitments nearly every day. Many of these operational tasks have strategic and tactical importance. Annually, there are over 20 joint exercises identified by Commander, U.S. Pacific Command, and nearly 150 exercises identified by Commander, U.S. Pacific Fleet. At least ten of these exercises involve a high level of ship participation. Additionally, there are requirements levied on the ships that operate in the Western Pacific by the SEVENTH Fleet Commander to support various requirements such as carrier escort missions and theater security cooperation. In 2015, the average number of days underway for the Cruisers and Destroyers, assigned to Commander, SEVENTH Fleet was 116 days. In 2016, it increased to 162 days as shown in figures 6.3 and 6.4 below.

Figure 6.3: No. of days spent in major availabilities, regular maintenance, inport and underway for Japan-based ships in calendar year 2015.

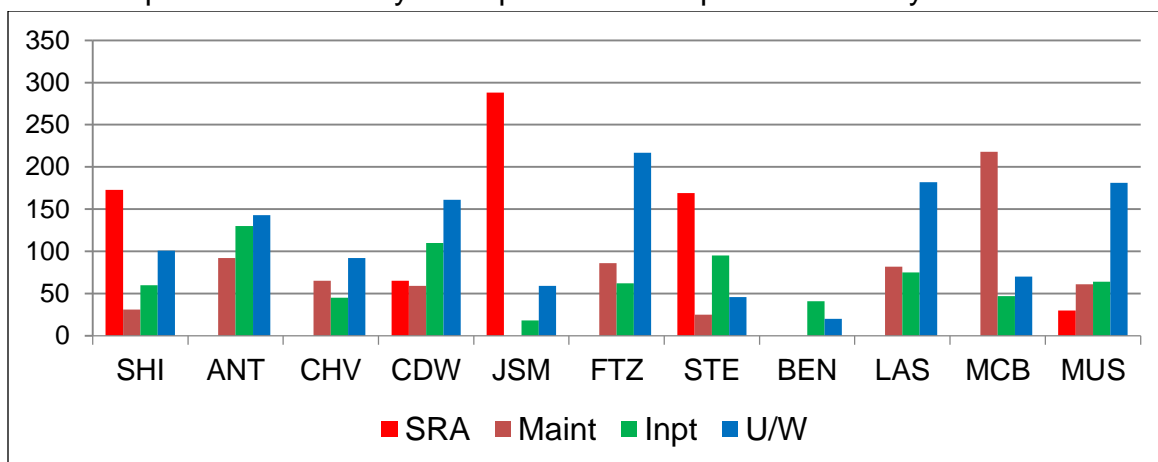
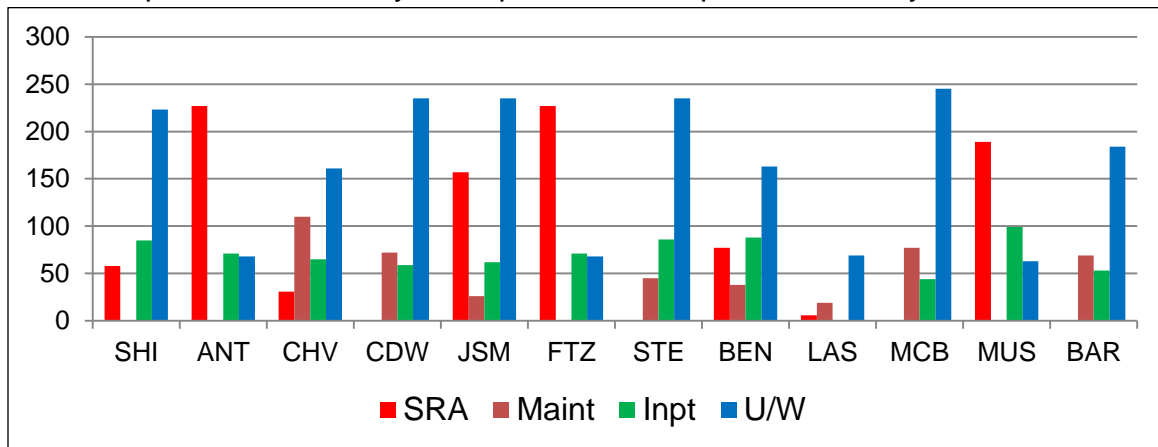


Figure 6.4: No. of days spent in major availabilities, regular maintenance, inport and underway for Japan-based ships in calendar year 2016.



Since 2015, operational requirements for the Western Pacific have increased dramatically. The Review Team found that these operational requirements were coming from multiple sources and were not always prioritized to allow proper adjudication based on the readiness of forces available – every task was a priority. As a result, additional forces were generally not requested or assigned. This led to an increase in operational tasking for Yokosuka-based ships at the expense of planned CNO Maintenance Availabilities (CMAV) and training. As data was indicating a decline in readiness, higher headquarters did not recognize the aggregate risk of the pace of operations and did not take action to correct the imbalance between the generation and employment of Japan-based forces. Finally, having a single commander balance the risk of readiness generation and force employment requirements from multiple sources may complicate responsibility and accountability for both aspects.

6.2 Findings

U.S. Navy ships have been based in Yokosuka, Japan, since the Korean War. In 1973, the Navy established the first forward deployment of a Navy aircraft carrier and her escorts with the USS Midway (CV 41) Carrier Battle Group. From that point on, the U.S. Navy has routinely based a carrier and multiple surface combatants in Yokosuka. The U.S. Navy has also based ships in Sasebo, Japan, since 1980. These ships are amphibious ships and minesweepers. The advantages of homeporting naval forces in Japan include the ability to provide immediate presence and response in support of

national objectives. Additionally, these forces routinely operate alongside allied and partner navies, and become expert in the operating environment in the areas of the Western Pacific important to America's interests.

The Review Team found the increasing demand for ready and certified ships to support operations in the Western Pacific exceeds the quantity that can be reasonably generated from Japan-based ships under their existing readiness generation model cycle. In their attempt to meet this demand, SEVENTH FLEET reduced the amount of time set aside to train Yokosuka-based ships. These factors are contributing to the erosion of training and material readiness of ships based in Japan, and have resulted in an increase to the operational risk to mission accomplishment.

6.2.1 Force Generation

The cruisers and destroyers (CRUDES) based in Japan are among the most capable in the surface force, and they are also among the oldest ships in the inventory. The average age of the Cruisers based in Japan is 28 years and the average age of the Destroyers is 21 years. As a result, the time required to modernize and maintain these ships has also increased, which directly impacts their overall operational availability.

Maintenance availabilities conducted by the U.S. Naval Ship Repair Facility and Japan Regional Maintenance Center (SRF) in Yokosuka, Japan, are getting longer due to growth in scope of maintenance required during depot-level maintenance periods and an increased number of ships based in Yokosuka. Further, the decision to execute more complex modernization periods, meant to refresh and upgrade ships' hull, propulsion, navigation and combat systems, has also required longer-than-planned maintenance periods. Compounding the problem, the growth in maintenance and modernization workload has grown faster than SRF can add capacity; since 2012 SRF workload has increased by over 15 percent while capacity has grown by ten percent. As with many industrial enterprises, there is a lag between SRF hiring an individual and full productivity from that individual that exacerbates the challenge. Additionally, past restrictions on the duration of overseas assignments resulted in higher turnover of those SRF positions filled by U.S. citizens. This reduced the experience level within the SRF workforce beginning in 2012.

The increase in required maintenance and modernization periods, compounded with operational tasking, has effectively limited time available for training on Japan-based ships. Without the necessary time to train, the required exercises to recertify in a particular mission area are compressed. Consequently, nearly 100 percent of Japan-based ships have one or more expired certifications, and in each case, a Risk Assessment Mitigation Plan (RAMP) is in place. As discussed in Section 6.1.1, the RAMP should include meaningful mitigation measures and a plan to attain the mission area certification. The RAMP is intended to ensure that the training risk is accurately identified by the ship and headquarters, and that the headquarters have assessed the mitigation plans as adequate.

The Review Team found that rather than providing an adequate plan to define and mitigate operating risks until completing the necessary actions to recertify, the RAMP process was largely used to communicate missed training or personnel shortages and the schedule to recover. These reports gave the appearance that ships were persistently available even without full certification. Compressed time between missions and required in port maintenance limited the CO's ability to establish training time and focus on improvements to weak areas identified through operations and exercises. Further, there was limited time for ships to implement lessons learned during training opportunities or repeat exercises in order to gain proficiency and/or maintain standards.

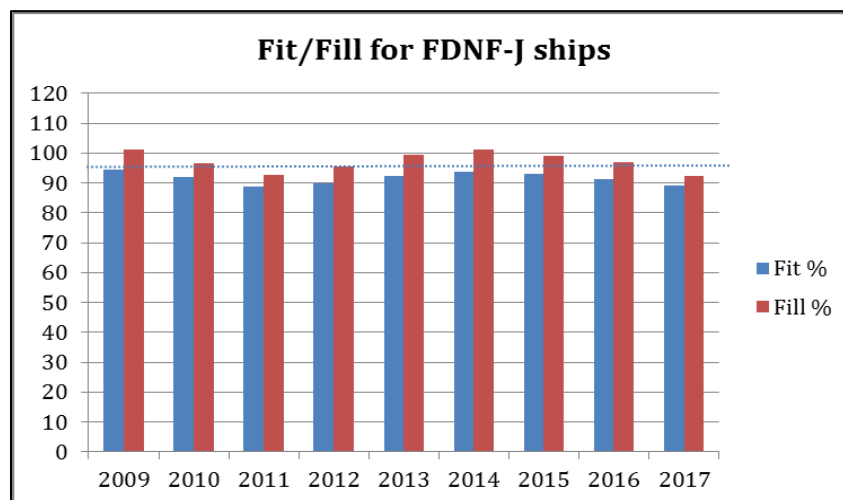
The Review Team found that manning distribution is not fully aligned and synchronized with the readiness generation and force employment needs of Yokosuka-based ships. Surface force ship manning levels declined Navy-wide during the 2009-2013 time period as a result of downsizing initiatives, the implementation of optimal manning (reduced manning) standards on ships, and other cost saving programs.

Investments were then made from 2014 to 2016 to increase fleet manning and reduce surface ship gaps; further, all FDNF and CONUS ships and squadrons had their fill and fit adjusted so that all FDNF ships and other deploying ships could deploy with the same level of manpower readiness. This resulted in a decrease for FDNF-Japan ships from 95 percent fit / 95 percent fill to 92 percent fit / 95 percent fill (meaning 7-8 crewmembers on a DDG may be "fit" to the ship from outside the apprentice,

journeyman or supervisor ranks, but the total number of sailors aboard ship would remain the same); this action helped enable an increase for FDNF-Rota ships and all CONUS deployers from 90 percent fit / 90 percent fill to 92 percent / 95 percent.

Surface ship manning levels began declining below these 92 percent fit / 95 percent fill standards for deployers across the Navy in 2016 and continue today, primarily caused by underfunded manpower total ownership costs, a high number of apprentice level enlisted rolling ashore after increased manning of sea duty assignments in 2013-2014, a lower number of accessions in 2016 (and for all FDNF-Japan, Rota, and Bahrain ships) due to unaccompanied/accompanied tour length policies and sea duty and overseas screening processes.

Figure 6.5: Manning fit/fill for Japan-based surface ships.



Temporary assignment of personnel is one mechanism that can be used to mitigate a critical-skill shortage (e.g., search-and-rescue swimmer). Often this process is accomplished by taking sailors from a ship in maintenance and sending them on temporary duty to operating ships. There are benefits of executing this process: sailors from ships in maintenance can maintain or gain proficiency aboard a more frequently operating ship, and in turn, operating ships can close critical skill gaps in their ship's complement when underway for operations. This practice can also impact the temporarily assigned sailor by reducing the opportunity to complete school or training while in port. Additionally, this practice reduces the overall number of sailors remaining on the in-port ship to complete daily tasks while in maintenance and places additional stress on affected sailors and families. Manning shortfalls contributed to overall

degrading quality of work and life for ships' personnel based in Yokosuka, a key tenet of a functional readiness cycle. This gap, coupled with high operational tempo, impacted some ships' ability to sustain individual tempo for the Sailors while still trying to meet operational and training expectations of a fully manned ship.

On the whole, a judicious and targeted use of temporary assignments can provide benefit to both the individual involved and the ships if the challenges are properly mitigated for the sailor and for both units. In many instances, these temporary fills did not take into consideration the specific qualifications required for a ship's specific configuration. Further, the Review Team found no formal ISIC or Type Commander policy exists that specifically addresses the temporary assignment of the right personnel or manage their qualification process for the (temporary) gaining ship for Yokosuka-based ships.

Prior to 2015, the resources available from Japan-based ships were adequate to meet the operational demands in the Western Pacific using a deliberate employment scheduling process. Since 2015, operational demand has increased significantly in the Western Pacific to support high-priority national tasking including BMD and presence missions, in addition to dynamic tasking to support exercises and experimentation (further details provided in Appendix 8.10). The shift from deliberate planning to dynamic tasking placed a burden on the ships trying to recertify because of the unpredictability of schedules. The increase in BMD mission requirements is not unique to SEVENTH Fleet (see Appendix 9.10). The Navy should evaluate overall BMD capacity in the fleet to determine the necessary force structure (platforms and capabilities) to support the expected near and long-term mission requirements.

6.2.2 Force Employment

The Review Team found that having a single commander balance the risk of readiness generation and force employment requirements from multiple sources often sub-optimizes the foundational maintenance, modernization and training needed to develop the readiness necessary to meet the Navy's statutory responsibility to organize, train, and equip the force. The current Force readiness generation structure for Yokosuka-based ships has complicated accountability and responsibility for training and

certification, as well as force employment. The Review Team found that without a command and control structure that clearly delineates the responsibility, authority, and accountability for force generation and force employment, the tendency to employ forces without proper maintenance and training will likely remain.

With the increased demand for ships in the Western Pacific, the rigor of executing employment scheduling conferences was not maintained by SEVENTH Fleet. This led to a greater reliance on “dynamic tasking.” No scheduling conferences have been held since November 2016. Additionally, the SEVENTH Fleet headquarters had not executed a disciplined process to prioritize the tasks and missions assigned to Japan-based ships, resulting in escalating requirements for operations. Operational requirements gradually took precedence over training and maintenance, and resulted in decisions to employ ships that have not been given the time to train and certify in all required mission areas. For example, in FY16 and FY17, 10 of 18 and 6 of 16 CMAVs were rescheduled, canceled, or shortened. Some of the deferred maintenance is executed in Windows of Opportunity (WOO) periods, but the execution in a WOO is less efficient because of ship schedule uncertainty.

The decision to employ forces that were not certified in one or more mission areas was effectively made under the SEVENTH Fleet Commander’s authority for operational control of its assigned forces and is inherent in the responsibility to assign tasks, designate objectives, and give authoritative direction necessary to accomplish the mission. However, these decisions were made without full understanding of the true readiness of the ships, and the decisions relied too heavily on acceptance of a RAMP. The Review Team found that the RAMP process was not an effective tool for accurately assessing and mitigating risk. Force employment decisions were often made without regard to the cumulative fatigue that near constant operations potentially have on a crew as well. Consequently, the resultant risk was left to individual Commanding Officers to execute assigned missions with whatever mitigations they thought appropriate.

6.3 Recommendations

6.3.1 Force Generation

1. **Develop a force generation model for ships based in Japan that addresses the increasing operational requirements, preserves sufficient maintenance and training time, and improves certification accomplishment.** [CPF, 31Dec2017]
2. **Conduct comprehensive Ready for Sea Assessments to determine the material and operating readiness for all Japan-based ships.** [CNSF, on-going]
3. **Permanently establish Naval Surface Group Western Pacific as an Echelon IV, Immediate Superior in Command administrative headquarters responsible for maintaining, training, and certifying FDNF Japan ships.** Evaluate establishing a similar activity in Rota, Spain and Everett, Washington. [CPF/USFF/CNSF/CNSL/C6F, ongoing]
4. **Cancel all existing Risk Assessment Mitigation Plans until all Ready for Sea Assessments are complete.** [CPF Immediate]
5. Evaluate the utility of the RAMP process as a risk management tool and make changes as appropriate. [CPF, 31Dec2017]
6. Evaluate and recommend a maintenance and modernization scheme for all Yokosuka-based ships that takes into account the operational requirements, the training, SRF&JRMCM and industrial base capacity and make recommendations for improvement. [OPNAV/USFF/CPF/NAVSEA, 30Jun2018]
7. Evaluate the OPTEMPO requirements applicable for forward-deployed units and revise control measures to account for the unique operational cycles for FDNF. [OPNAV, 31Dec2017]
8. Evaluate the current alignment of SRF and JRMCM to Commander, U.S. Pacific Fleet and determine if changes in owner/operator structure are needed. [OPNAV/CPF/NAVSEA, 31Dec2017]

6.3.2 Force Employment

1. **Restore the SEVENTH FLEET deliberate employment scheduling process to improve operational planning and risk management.** [C7F/CPF, immediate]

2. **Establish formal policy for requalification requirements for personnel temporarily assigned to ships and when changes in equipment configuration occur.** [CNSF/CSF/CNAF, 30Nov2017]
3. **Establish a single Echelon II higher headquarters responsible for the readiness generation of all Navy forces.** [OPNAV/USFF/CPF, 30Sep2018]
4. Evaluate existing “redlines” policy with respect to navigation, RADAR, steering, and propulsion systems. [CNSF, 30Nov2017].
5. Improve the overseas and sea duty screening process to more rapidly identify those who will not screen for overseas and/or sea duty and to accelerate the process to identify replacement candidates. [CNP, 31Mar2018]
6. Evaluate all current operational requirements in the Western Pacific and prioritize operations with available resources. If assigned forces capacity is not sufficient to source the requirement utilize the Global Force Management process to request additional support. [C7F/CPF, 30Nov2017]

7. SEAMANSHIP AND NAVIGATION EQUIPMENT READINESS AND UTILITY

7.1 Introduction

Ensuring the utility of ship equipment needed to safely navigate begins with the Chief of Naval Operations staff codifying concepts of operations into requirements to be used as the basis for ship design. These operational requirements become the basis for acquisition and cradle-to-grave life-cycle support by Program Managers within the Program Executive Offices (PEOs). Some of those high-level requirements are translated into concrete models for Bridge watchteam structures, to include the type of individuals selected to operate consoles and the desired foundational training. Then, engineering organizations design, certify, integrate, and test the equipment matched to those watchteams, and they develop documentation and training to prepare operators and technicians to use and maintain those systems. Once the surface force Type Commander accepts new equipment and certifies it ready to operate, ships and supporting maintenance activities maintain equipment readiness to established standards to ensure capability and redundancy at sea or in battle. These standards for material condition are also enforced for at-sea training to ensure normal system configurations and procedures and to build proficiency through training.

There are no causal factors in the four representative mishaps linked to material readiness of equipment needed to safely operate at sea. The Review Team identified a number of findings that made getting ready and staying ready more difficult. First, the Navy should improve the ability of Commanding Officers to validate their self-assessed material condition and the proficiency of their technicians and operators with less time-demanding engagements on their ships. Second, the Navy should consolidate responsibility for all Bridge system operational and technical requirements to improve management of ship Bridges as integrated control rooms. Lastly, the Navy should improve the application of modern human factors engineering to the Bridge, and Bridge consoles, during modernization.

7.2 Findings

7.2.1 Inspection, Certification, and Assist Visits (ICAV)

As outlined in the Surface Force Readiness Manual, the goal of ICAV is to ensure Sailors deploy with their ship at peak readiness and they are properly prepared to overcome equipment challenges at sea. ICAV was created to consolidate and optimally manage shore-to-ship assistance with minimal burden to the ship. Currently, the sheer number of visits by external organizations often creates a burden on ship's crews and they do not provide an objective validation of crew proficiency and self-sufficiency. Examples of visits include navigation system certification, preventative maintenance assessments, Afloat Training Group events, and the series of material condition assessments collectively called the Total Ship Readiness Assessment (TSRA). Ships can be subjected to as many as 238 separate inspection, certification, and assist visits in a 36-month period. The ICAV process should be better planned and executed to eliminate duplication of effort and better support Sailors and the consistent readiness of their equipment. Each visit can be made more effective if deficiencies found were summarized and provided to ship Commanding Officers with objective measures of performance and candid comments on weaknesses to allow for focused improvement. Further, it should come in a format that supports both Type Commander and Systems Commander trend analysis. Related visits should be combined by planning them from a ship's perspective; sending teams to assess equipment supporting ship functional areas (e.g., Bridge systems) or ship divisions instead of planning visits around the responsibilities of shore organizations. The scope and scale of assistance Sailors receive from outside organizations costs them valuable training time and often does not directly address their manning, training, or equipment needs.

The lack of objective executive level feedback following ICAV visits is preventing meaningful improvement as Commanding Officers have to carefully mine voluminous, detailed reports gathered by specialists and presented in a variety of formats to ascertain where they need focused improvement. The most candid feedback on problem areas is currently provided expert-to-expert (e.g., at the Chief Petty Officer or Leading Divisional Petty Officer level). While visiting teams intend to be helpful, many

team members indicate they want to avoid “putting Sailors on report” without giving them an opportunity to improve. So the lack of objective grading and candid feedback in out briefs and reports prevents trending on ships, across ships and by Commanding Officers. Additionally, the scope of each visit tends to be defined by the responsibility of the ashore sponsoring organization without consideration of what is most effective from the crew’s perspective.

As an example, Naval Sea Systems Command (NAVSEA) conducts navigation certifications (NAVCERT) for all surface ships. (This is not to be confused with either the ATG navigation certification, which focuses on crew proficiency, or the ship’s ISIC navigation check-ride, which validates that a ship is safe to go to sea for testing and training following extended availabilities.) The NAVSEA NAVCERT focuses on the material readiness of navigation systems to support safe operations at sea, primarily in time-keeping and geo-positioning the ship. The NAVCERT process also assesses Sailor proficiency in maintaining equipment on their own, between certifications, and while operating at sea.

Review of navigation equipment discrepancies data from ships involved in the mishaps led to broader analysis across the Navy. Although provided with the same basic navigation equipment, NAVCERT surface ship performance is consistently lower than submarines. Figure 7.1 shows the average number of deficiencies found through NAVCERT by ship class over the past two years. Deficiencies found are reported to ships in real-time for tracking. High-Risk deficiencies are certification-limiting, and prevent NAVCERT close-out. If ship operations are needed prior to resolution, a departure from specification is required. When asked to explain the differences in performance among platform classes certifying authorities, experts noted that unlike surface ships, submarines technicians are both operators and maintainers and tend to demonstrate higher proficiency and standards.

Figure 7.1: Average no. of navigation equipment discrepancies past two years

Ship Class (<i>sample size</i>)	Total at Start (<i>High Risk</i>)	Total at End (<i>High Risk</i>)
CRUDES and MCM (40)	35 (6)	18 (0)
AMPHIB and CVN (20)	68 (12)	23 (0)
SSN and SSBN (24)	6 (2)	1 (0)

When reviewed in aggregate, the metrics collected through the training and certification processes show consistent inaccuracy in ship's self-assessment of their material condition overall. As an example, analysis of Board of Inspection and Survey (INSURV) reports indicate that on their own, surface ships only captured an average of 18 percent of the material deficiencies that INSURV finds when observing ships performing the same maintenance. Other ICAV visits such as the 3M certification and TSRA confirm a steady trend of low-accuracy in surface ships Current Ships Maintenance Plans (CSMP), which capture and track all material deficiencies onboard a surface ship. This impedes effective planning for maintenance and impacts the ability of ships and their chains of command to assess readiness and mitigate operational risk.

While there are no equivalent objective measures for operator and technician level-of-knowledge and proficiency in interacting with their equipment, the magnitude of inaccuracy in ship self-assessment suggests substantial gaps in crew level of knowledge in system design and maintenance procedures. When visit reports include raw data that suggests poor crew performance, the reports do not convey any executive level perspective so that Commanding Officers or higher authorities can focus efforts on improving readiness and self-sufficiency. Additionally, inaccurate material condition data leads to growth in maintenance periods which ultimately takes away from time dedicated to training and operations. Surface Maintenance Engineering Planning Program (SURFMEPP) data confirms the undefined backlog of ships' force material deficiencies as a principal cause of unacceptable growth between planning and execution, which prevents ships from returning to sea on time.

Visiting certification teams respond to the demand for readiness and operations by helping ships as much as possible, to include entering deficiencies into ships' maintenance systems, ordering material, and performing direct corrective actions. While well intentioned, and helpful in the short term, this can undermine certification of self-sufficiency and technical proficiency. The existence of persistent, moderate deficiencies at the time of certification also increases the risks of operationally impacting failures at sea. With adjustments in scope and the quality and candidness of feedback in out-briefs and reports, current engagements such as NAVCERT could provide ships better insights in where improvement is needed to maintain readiness on their own and

operate safely. Multiple additional opportunities within the ICAV set of engagements for similar adjustments to scope, consolidation of related visits, and cessation of redundant or low-value visits were identified anecdotally and merit further review.

7.2.2 Bridge System Modernization and Training

There is sufficient sensor data available in Navy combatant Bridges and CICs to clarify and amplify what can be seen by eye and allow safe ship maneuvering and navigation. However, the Navy should improve the clarity and consistency of guidance to ships on how to man and operate Bridge systems. Additionally, the Navy lacks clear accountability for delivering effective training to ships undergoing modernization.

When integrated by watchteams as designed, Navy ships are equipped with a navigation “system-of-systems” that exceeds IMO standards. Yet, in recent mishaps, some ships did not use all available sensors to amplify direct observations (e.g., enhanced optical sensors, RADAR, and AIS), did not use installed tools to assist integrating the CIC surface contact picture for Bridge watches (e.g., Bright Bridge), and were unfamiliar with ship control systems. Unlike modern civilian ship Bridges, designed to routinely operate with two (cargo ships) or four (cruise ships) licensed and unlicensed watchstanders, most Navy ship Bridges remain laid out in a manner tied to their history and they still rely on relatively large Bridge and CIC watchteams to safely operate in dynamic, tactical conditions by design.

At present, modernization of ship Bridge arrangements and systems is not engineered and managed holistically as an integrated control room over its lifetime. Without centralized ownership and tight alignment between changes in high-level operational requirements, intent and timelines for modernizing Bridge systems, and oversight of the capabilities and training needs for ship operators has resulted in: (1) increasing complexity with suboptimal human factors engineering, (2) inconsistent configuration control and gaps in equipment specific training, and (3) declining support for navigation RADAR systems.

The large number of different Bridge system configurations, with increasingly complex and ship-specific guidance on how to make them work together, increases the burden on ships in achieving technical and operational proficiency. The variability and

complexity from ship to ship makes managing individual qualification on specific equipment more important; but it also makes it more difficult. Ships require better support from Systems Commands and technical support functions ashore in merging the influx of operational and technical guidance and clarifying steps needed to requalifying their Sailors following periods of modernization.

Because the Navy is warfare oriented, the design of a ship's CIC receives significant rigor and undergoes a disciplined and cohesive process at the SYSCOMs. Surface ship CICs are well laid out ergonomically and their design is sustained between concepts of operation, technology design, and training through a ship's life cycle. The same level of rigor is not in place for the design of the Bridge. With the exception of newly designed platforms, the sensors and sub-systems relied on by surface ship Bridge watchteams are independently designed, certified, and modernized by distinct technical and program management organizations responsible to field, maintain, and modernize their systems in support of distinct operational functions and not the Bridge-as-control-room. In general, ship operational requirement documents have not driven more effective Bridge equipment integration and management by NAVSEA and acquisition offices inside the Navy. The exceptions include LCS and DDG-1000, where the design of the Bridge around a "cockpit" model forces tighter control and up-front integration. Each organization remains motivated by sound, but different objectives, and there is not a strong unifying force to drive collaboration and coordination during modernization cycles. Some of these issues were self-identified by NAVSEA and Program Executive Offices (PEOs), which are responsible for acquisition in the Navy, during the introspective assessments performed as part of the CNO-directed operational pause.

Although coordination of a team is inherent in the ship design, the Navy requires clearer integrated guidance for ships to consistently man and operate Bridge support systems in the context of that design. The NAVDORM describes watch positions primarily related to navigation, but does not prescribe when those positions are to be set. Commanding Officers generally model their watchteams after those in place before they took command or based on expectations they developed from firsthand experience on prior ships. No one interviewed could identify a resource available to them to learn

how installed equipment was intended for use together in various operational scenarios. Not surprisingly, practices vary substantially.

From the 1990s to today, the Navy has been through periods of substantial change in policy and technology that eroded collective oversight and control of Bridge systems. As described below, long standing watchstanding practices were changed between 2001 and 2004 to reduce manning. In 2013, after completion of the Fleet Review by Vice Admiral (ret.) Balisle, Navy leadership returned to past manning practices. However, clear corrective guidance was not issued to inform ships how to respond operationally after nine years of functioning in the context of (reduced) optimal manning on surface ships. Similarly, although modernization was underway to support optimal manning concepts, no revised guidance was issued to NAVSEA, leading to confusion about the design basis and intended use of newly fielded equipment.

During the optimal manning era, the Navy invested in smart ship programs to field “bolt-on” systems to help accommodate smaller watchteam sizes through automation and use of commercial-off-the-shelf (COTS) tools that are also employed by civilian merchant vessels. Bridge concepts mirrored that of merchant ships, with two to four person Bridge teams. At that time, modernization occurred in a piecemeal fashion, typically in-stride with new sensors and upgraded computer-based tools added incrementally as the Navy was able to deliver them. From 2003 to 2005 the Navy sought approval to use DDG 51 Class acquisition funding for the development of a more fully integrated Bridge under the optimal manning experiment model, with the design basis of three persons on the Bridge. Cost savings would be achieved over the life of the ship through reduced manning. The focus of that development was an integrated Bridge system allowing the helmsman to shift forward to a position where the JOOD could lookout and directly drive the ship under the supervision of the OOD. RADAR, AIS data, and electronic charting data would be integrated to adjacent consoles for use by the OOD with minimal support from CIC.

Progress in executing modernization plans has been slow. Integrating data from commercially available navigation systems into those systems used for combat operations has proven complex, expensive, and challenged by cyber security risks that have to be judiciously addressed and readdressed as environments and risk-

assessments change. The Navy delivered the first truly integrated Bridge control and navigation system hardware in USS John Paul Jones (DDG 53) and USS Michael Murphy (DDG 112) in 2011. The Navy did not initially permit integration of tools such as AIS, citing unmitigated cyber security risks to the ship. Since then, technical challenges which vary from ship-to-ship have impeded selective integration of AIS by Commanding Officers when desired and tactically permissible.

In parallel with continued modernization of Bridges for reduced manning, problems with supportability of legacy navigation systems were identified in 2011. As geo-positioning and timing equipment is integral and necessary for warfighting capabilities, a task force was initiated to bring “navigation wholeness” to in-service surface navigation systems. The task force’s findings in 2012 led to substantial urgent investment (approximately \$458 million budgeted over a five-year span) in modernizing some Bridge systems. Over this same period of investment, support and operational availability of the surface force’s primary navigation RADARs have declined. As an example, both SPS-73 and SPS-67 RADARs on forward deployed Cruisers and Destroyers are reported as consistently below operational availability thresholds for the last two years. Their replacement, Next Generation Surface Search RADAR (NGSSR), has been delayed due to underfunding.

In two of the mishaps, interoperability between SPS-73 and other Bridge systems, particularly AIS and ECDIS-N, remains problematic. AIS data was unable to be pulled into USS Fitzgerald’s SPS-73 console for improved situational awareness. In USS John S. McCain, a different problem that causes SPS-73 data to overload some versions of ECDIS-N when in heavy traffic, caused watchstanders to disable that interface. Similarly, ships with older versions of ECDIS-N cannot import AIS data in high traffic areas as it causes the ECDIS-N to overload and malfunction. While all sensor data remains available at separate consoles, it is not integrated into a single display. In response to declining support for repairs and challenges integrating systems as designed, some ships independently procure and install commercial RADARs that provide ARPA, AIS, and ECDIS on a single console. This practice adds to the complexity of Bridge system configuration control. Some commercial RADARs degrade other installed sensors and none have logistics or training support. A high pace of

modernization of interrelated Bridge systems along several independent paths continues today. Management by different technical organizations with different sponsorship, unstable funding, and the aforementioned security risks have disrupted plans and left the Navy in a period of continuous technological transition.

Gaps among Navy headquarters organizations that define and execute modernization strategies, and the Type Commander who issues operational guidance, impact the ability of ships to train, use, and maintain new equipment. The documents delivered to ships receiving the Integrated Bridge and Navigation System (IBNS), which includes extensive electronic control modifications to the legacy ship control consoles (helms), still retain optimal manning as their design basis, and those practices are included in training for the ships.

Of note, in USS John S. McCain, which had recently received the IBNS upgrade, the consolidated manning and training impact assessment provided to the ship ahead of her last modernization period omitted training requirements for enlisted rates that stand watch at the helm. While the guidance to USS John S. McCain was extensive, it was ambiguous in terms of impact to operator qualification and actions needed to prepare for certification; leaving much to the judgment of the ship only three months before installation began. In comparing that guidance with recent direction for a submarine entering modernization, the submarine is simply informed: "Installation of new tactical systems invalidates the following watchstander qualifications: Officer of the Deck (OOD) (Surfaced and Submerged); Contact Manager (Surfaced and Submerged); ... ; and Sonar Supervisor;" and so on. This direction also provided a clear phased plan for requalification with specific accountability for monitoring progress and updating readiness reporting systems throughout that process. There is not an equivalent assessment of qualification impact and direction for surface ships entering modernization periods. Of note, three of the four ships involved in the 2017 mishaps recently underwent maintenance periods with modernization.

Following the Fleet Review in 2010, which highlighted gaps in training, PMS 339 was established within NAVSEA to serve as a single point of contact to coordinate the complex interactions of "a standing committee [the Surface and Expeditionary Warfare Training Committee (SEWTC)] of knowledgeable and accountable representatives who

actively participate in the development and assessment of manpower and training requirements and resourcing solutions.” Commander, Naval Surface Forces (CNSF), as the Navy's lead for the Surface Warfare Enterprise, chairs the SEWTC, and PMS 339 is assigned its execution agent. Although SEWTC was modelled after its equivalent in undersea warfare, in practice, these committees behave differently. For the submarine force, Commander Submarine Force (CSF) representatives are the dominant voice in developing plans for approval, with a strong focus at the unit level; in the SEWTC the dominant voice is the Surface Warfare resource sponsor (OPNAV N96) with a focus on balancing competing fiscal requirements.

Since NAVSEA's PMS 339 branch was established, it has been effective at identifying the magnitude of the training system problems and has been effective at advocating for training needs through budget requests. However, as implied by instruction and discussed above, there is a committee involved in setting training priorities and “cut lines” for unfilled requirements; and following SEWTC action, it is unclear who is ultimately accountable for failures in providing training to the surface force. As a recent example, training developed for DDG-1000 systems and equipment as part of acquisition was delivered late and determined inadequate for use on a ship. Commander Naval Education and Training refused to accept the training delivered for use in Navy schools. Remaining acquisition funding was insufficient to bring the training up to Navy standards, and the reduction in the forecast size of the DDG-1000 Class reduced the calculated benefit for the significant projected cost. Ultimately, PMS 339 was assigned responsibility for managing this as a training gap. Currently, the PMS 339 staff is developing interim training plans to support DDG-1000 replacement crews.

Coordination between organizations involved in Bridge system modernization will benefit from improved and unambiguous governance. Extant policy documents and written instructions do not establish clear organizational responsibility and technical authority for life-cycle management of a ship's Bridge, to include assessing operational impacts of control and sensor modernization which lead to short term thinking. Most examples identified occurred when new acquisition Program Managers were under pressure to reduce costs and viewed “program-of-record” equipment as “too expensive” or “high risk.” As an example, RADAR systems with no responsible life-cycle manager

have been acquired and installed in ships (e.g., LPD-17 amphibious Class ships) and replaced shortly after delivery. In some cases, non-program-of-record RADARs have been installed by ships with support of acquisition dollars that are found to degrade performance of other sensors. Poor coordination and weak technical authority ultimately undermine efforts to establish strong configuration control and commonality on surface ship Bridge systems which are intended to reduce training and life-cycle support costs over the long term.

7.2.3 Human Systems Integration (HSI) and Human Factors Engineering (HFE)

HSI and HFE are complex topics that are broad in scope and generally mean different things to different people. For the purposes of this review, HSI includes assessing the Bridge layout, with emphasis on visibility and accessibility of critical information and controls needed in emergencies, watchstation ergonomics, as well as detailed assessments of the design of human machine interfaces. Recent design guidance used in surface ship modernization and acquisition contracts led to safety-critical equipment delivery without effective human machine interface reviews. Most ships and ship systems acquisition and modernization professionals have a limited understanding of HSI methods appropriate for use in ensuring delivered systems are sufficiently designed for both normal and emergency operating conditions. In IBNS, the selection of control types (e.g., discrete controls, such as physical levers, buttons, and knobs, versus touch screen controls), their spatial arrangement and density, as well as use of color schemes to clearly indicate out-of-normal conditions were inconsistent with best practices in industry for safety critical control panels.

As an example, the touch screen controls and displays for ship control consoles are sufficiently dense that most watchstanders interviewed use the back-up method (track-ball and button input) as the touch screen for throttle control is considered unusable. As another example, review of recent problem history identified that following installation of the integrated Bridge system (IBS), eight of the first 12 ships receiving the installation immediately reported intermittently losing throttle control when changing speed quickly. The underlying problem was determined to be differences in how network operating systems manage messages between control stations. Ultimately, it

took nine months to resolve the issue throughout the surface force. For safety critical controls interfaces, issues like these should be prevented through upfront analysis of human-machine-interface requirements and validated through qualification testing in advance of equipment delivery. If thorough human factors assessments, land-based testing, and design qualification are considered too expensive or time consuming, then modernization of these controls systems should not be undertaken.

There is a gap between the enlisted operator and maintainer foundational training and the procedures and control systems delivered today by the in-service Engineering Agent (ISEA). Some ships recognize the complexity and compensate with the presence of technicians assigned to the Bridge during special evolutions. During casualties affecting steering, thrust control, or navigation systems it is crucial that officers and other Bridge operators not become focused on equipment casualty response as their attention is needed to understand shipping and navigation hazards and communicating with other ships through signals and radios.

Beyond the potential inability of operators to diagnose an equipment casualty and take immediate actions in time to prevent mishaps, as occurred in USS John S. McCain, limited understanding of how automated systems function has been shown to increase the frequency of operator errors. In this context, unnecessary complexity in equipment or inadequate training for operators creates a latent hazard that may not be revealed during training or assessment of proficiency in conducting normal operations. There is a tendency of designers to add automation based on economic benefits (e.g., reducing manning, consolidating discrete controls, using networked systems to manage obsolescence) without considering the effect to operators who are trained and proficient in operating legacy equipment. Similarly, attempts to add flexibility with alternate modes of control demands operator attention to track modes of operation and stay aware of differences in system behavior. When considering the effects on operator cognitive loading, ability to make decisions with an uncalibrated degree of trust in automation, and potential increases in frequency of error, even modernization only intended to improve reliability can have the opposite effect when the whole human-machine system is assessed. Surface force IBNS operators interviewed noted the densely packed

display areas dedicated to errors and faults indicating that it is hard to interpret and the frequency of faults is distracting leading to normalization over time.

As an example, when Boeing introduced fly-by-wire in their 777, they deliberately retained conventional controls and went to lengths to ensure control system response felt the same to pilots to prevent impacts to proficiency. Reviewing controls in civilian ships, as well as United States Naval Ships (USNS, such as replenishment ships), show similar retention of discrete and familiar ship controls even as Bridge systems are modernized for electronic navigation. Naval Surface Warfare Center Dahlgren was identified as a center of excellence for human factors engineering within the Navy design community. Discussions with their leading experts revealed they had not been involved in specific reviews during modernization of Bridge system. The discussions also highlighted some gaps in their expertise specifically related to modern industrial standards for assessing HMI in safety-critical controls systems.

Although the NAVSEA critical design review of the ship control consoles and integrated Bridge and navigation system (IBNS, a later variant of IBS) installed on USS John S. McCain was ongoing during this comprehensive review, some of the interim findings include gaps in operating procedures governing the transfer of control that was attempted by USS John S. McCain crew, gaps in recommended and required training and procedures for Bridge watchstanders operating new consoles, and unclear guidance for each ship on the setup and operation of AIS, SPS-73, and electronic chart systems together for maximum situational awareness.

7.3 Recommendations

1. **Consolidate responsibility and authority for Bridge system modernization and improve methods for human systems integration.** Establish a single authority responsible for all Bridge system operational requirements aligned with a single engineering authority responsible to the Navy for management of the Bridge and Combat Information Center systems as an integrated control room over the life of each ship class. [OPNAV/NAVSEA/PEO IWS, 31Mar2018]
2. **Accelerate plans to replace aging military surface search RADARs and electronic navigation systems.** Fully fund development and implementation of Next Generation Surface Search RADAR. [NAVSEA, 31Mar2018]

3. **Improve stand-alone commercial RADAR and situational awareness piloting equipment through rapid fleet acquisition for safe navigation.** Identify, acquire, install and provide the maintenance and training support, for an appropriately positioned common commercial RADAR system on all surface ships. Remove existing non-supported commercial RADARs and establish policy preventing installation of commercial sensors without authorization. [NAVSEA/CNSF, 31Mar2018]
4. **Perform a baseline review of all inspection, certification, assessment and assist visit requirements to ensure and reinforce unit readiness, unit self-sufficiency, and a culture of improvement.** The goal of this review should be to reduce the overall burden on ships by eliminating low value engagements and refocus remaining actions on validating unit readiness, unit self-sufficiency, and improvement. [CNSF/NAVSEA, 31Mar2018]
5. **Numbered Fleet Commanders establish appropriate policies for surface ships to actively transmit and use Automatic Identification Systems (AIS) when transiting high traffic areas.** Consider if similar guidance is needed for submarines. [C3F/C4F/C5F/C6F/C7F/CTF80, immediate]
6. Share lessons learned and operational guidance from the on-going technical review of USS John S. McCain systems and procedures. [NAVSEA, 30Nov2017]
7. Immediately develop and release a fleet advisory on safe and effective operation for all variants of ship's steering systems in all modes of operation. [NAVSEA, immediate]
8. As an immediate aid to navigation, update AIS laptops or equip ships with hand-held electronic tools such as portable pilot units with independent ECDIS and AIS. [CNSP/CNSL, 31Mar2018]
9. Accelerate plans to transition to ECDIS-N versions 9.4 and greater on all ships with hardware that secures its connection and allows full AIS integration. In the interim, NAVSEA and Type Commanders should jointly develop ship specific guidance on how to configure and operate ECDIS-N, RADARs, and AIS to maximize reliable situational awareness, reduce cyber vulnerability, and best meet the intent of IMO standards. [NAVSEA/PEO IWS, 30Nov2017]
10. Survey ships with integrated Bridge systems for feedback and lessons learned. [NAVSEA, 31Mar2018]

11. Conduct design and procedural reviews to reassess all variations of Bridge control systems in the fleet with focus on the complexity, suitability of human machine interfaces, and reliability of the underlying safety-critical control systems for thrust and steering. [NAVSEA, 31Mar2018]
12. Assess the alignment between foundational training for enlisted operators and technicians and the technology used in integrated Bridge system consoles to ensure operators can take appropriate actions in response to equipment casualties. [NAVSEA, 31Dec2017]
13. Develop standards for including human performance factors in reliability predictions for equipment modernization that increases automation. [NAVSEA, 31Mar2018]
14. Update and define the Bridge and CIC watchstation requirements during all operating conditions in the SORM, NAVDORM, and EDORM. [CNSF, 31Mar2018]

[PAGE INTENTIONALLY LEFT BLANK]

8. SYSTEMIC PROBLEMS

8.1 Introduction

The surface force is operating under difficult external conditions. Globally and domestically, the Navy is expected to adapt quickly and operate amidst uncertainty and change. Many of its leaders resourcefully find ways to generate strong teams in that environment with sufficient resiliency to succeed; however, even within those commands, continued success is not guaranteed, and culturally the surface force is not actively seeking identifying and trending precursors that could lead to mishaps. Even when presented with information that indicates standards of readiness are not met, rather than pausing and aggressively determining what is needed to correct the problem, the surface force is conditioned to mitigate the risk through some action that lessens the severity of the problem, and then proceed on with the mission. This tendency does not prevent problems from occurring in the future.

Without the benefit of objective data to trend precursors to mishaps, leaders will not have the knowledge to make institutional corrections to prevent future incidents from occurring. Leading up to 2017, the raw number of mishaps had been on a slow, but steady decline, which helped to instill a false sense of safety and security. While flaws in that assessment are easily seen retrospectively, the surface force did not have robust methods for objectively measuring leading indicators of decline, nor trained people in place to proactively find gaps in existing safety analyses to effectively drive change. To improve the predictability of team and unit performance, judiciously applied evaluations must properly grade and calibrate the ship's internal programs and processes including planning, preparation and execution.

The common causal factors identified in the majority of the mishaps center on individual and team performance. Understanding the human performance factors involved is important to determine appropriate long-term corrective actions. Elements such as endurance, fatigue, team dynamics, and models of learning must be considered.

8.2 Findings

8.2.1 Critical Assessment and Learning

Surface ships may receive over 200 Inspections, Certifications, and Assist Visits (ICAV) every 36 month cycle. The Review Team found that, collectively, the large effort expended does not consistently result in crews, Commanding Officers, or their ISICs developing accurate or meaningful information on capability, nor does it drive a culture of learning and improvement. Recently, the Surface Type Commanders have implemented a reporting requirement for near-miss events with specific guidance on “cultural breakdowns.” This effort is a step in the right direction because it is a non-punitive process that can capture near real-time data that can be meaningfully incorporated into training curricula and processes.

This process of developing near-miss learning must ensure appropriate focus on precursors, instead of reactive details of an actual mishap in order to increase the margin and learning for operating safely at sea. The right data and trend analysis enables decision makers at any level to make systemic improvements before a problem occurs. Furthermore, extensive trend analysis will reveal more areas or periods of vulnerability. For example, three of the four ships had just come out of an extensive SRA and had been dynamically tasked to support continuous operations. In retrospect, ships immediately operating after an extended maintenance period are more vulnerable when it comes to proficiency and basic safe operations at sea. Some would counter that historical data does not support a relationship between ship employment following long periods of upkeep and an increased risk of mishaps at sea; however, recent events demonstrate that the lack of previous mishaps may have been a function of other factors or mitigations.

Poor analytics and data visualization leads to wrong conclusions. For example, a 2013 safety briefing to senior leadership concluded that there is “no apparent correlation between training or lack of training opportunity to increase in mishap rate.” However, a revisit of the raw data revealed elementary analytic techniques that resulted in misleading macroscopic trends, thus disarming the decision makers and diluting the risk management process.

The Naval Safety Center has a broad mission that includes responsibility for evaluating operational risk as well as occupational health and safety. Driven by regulatory requirements (and enhanced by the relative ease in collecting injury statistics), the safety center's most effective trending tools capture information important to occupational safety and health. The data available to guide understanding of operational safety risks is limited to what can be derived from mishap and hazard reports provided to them. As such, their analysis has seldom yielded unique insights or recommendations applicable to particular mishaps or to broader performance improvements. Recommendations typically echo solutions captured singly in investigations without addressing systemic or human factors problems as they are understood by the scientific community. Similar conditions were present within BP and in the government regulatory agencies responsible for oversight in advance of the catastrophic events surrounding the loss of the Deep Water Horizon in the Gulf of Mexico.

The rigorous application of critical self-assessment can reduce the deviation from expected standards. Processes such as the Plan, Brief, Execute, Debrief (PBED) focus on specific evolutions or events, and are useful at the unit level. However, a more holistic assessment to understand performance trends and identify systemic issues is needed for all levels of command. Corrective actions will be most effective when a culture of safety matures to the point where knowledge meets capability, and all levels of command are operating interdependently, with greater teamwork at their respective levels, and a heightened awareness of the adequacies of their actions with respect to the Navy's goals.

The cumulative effect of poor critical assessment resulted in three principle modes of failure, which are highlighted in each of the four incidents that occurred this year: failure to *plan*, failure to *practice*, and failure in *execution*. With planning: our Commander's options to accomplish a greater number of missions have incrementally placed a greater emphasis on rationalizing deviations where planning did not reinforce challenging the assumptions. On practice: well before the Bridge watchstanders assumed the watch, they had not rehearsed emergency or extremis situations; in

execution: ships and headquarters failed to question if what they were doing was adequate to what they needed to do, and make corrections.

Figure 8.1: Conditions of Failure Matrix

	Failure in <i>Planning</i>		Failure in <i>Practice</i>	Failure in <i>Execution</i>
	Plan not explicit	Plan not stress tested	Extremis situations not practiced	Normalized Deviance Don't see/solve problems
Antietam	<ul style="list-style-type: none"> • Did not apply weather to the anchoring brief • Watchbill not signed • Wrong chain length planned 		<ul style="list-style-type: none"> • Practice anchoring in bad weather? • Rehearse changing situation, push on or change plan? • ATG assessing, not helping 	<ul style="list-style-type: none"> • Crew lost margin of error, but didn't reassess risk • CO lost SA; distracted others • CO gave wrong orders
Lake Champlain	<ul style="list-style-type: none"> • Improperly tuned RADAR • Watchbill discrepancies 		<ul style="list-style-type: none"> • No discussion or training of emergency actions • Not recognizing indicators leading to risk of collision • Substandard use of lookouts 	<ul style="list-style-type: none"> • Watchbill actual ≠ assigned • Loss of SA, but maintained Course/Speed • Violation of Nautical Rules
Fitzgerald	<ul style="list-style-type: none"> • Night orders deviation from standard • SOA/PIM changes not understood 		<ul style="list-style-type: none"> • JOOD tunnel vision on Port, with traffic to Starboard • Substandard use of lookouts • No use of AIS • Helmsman confused 	<ul style="list-style-type: none"> • No maneuvering board • Watchstanders loss of SA • Helmsman confused • CIC backup not solicited • Violation of Nautical Rules • OOD failure to act
McCain	<ul style="list-style-type: none"> • Wrong personnel at brief • Watchstanders not qualified 		<ul style="list-style-type: none"> • Did not understand steering equipment • Helmsman not proficient • Substandard use of lookouts • No use of AIS 	<ul style="list-style-type: none"> • No recognition of steering control changes • Helmsman overwhelmed • CIC backup not solicited • Violation of Nautical Rules • OOD failure to act

Additionally, as discussed in more detail in Chapter six, higher headquarters did not have sufficient data to understand the true risk based on the actual readiness state of the ships when making employment decisions. Without the backstop of a strong assessment program, the surface force is susceptible to the impact of cultural drift within a command and in the force as a whole. Not having a process in place to assess instances of organizational drift allows for an accumulation of accident risk over time that is generally unrecognized by individuals both inside and outside of the command.

Non-compliant actions or inactions were not unique to the day of the respective mishaps. Several existing, accepted practices did not conform with written standards. For example, in the mishap involving USS Lake Champlain, some watchstanders in CIC believed that a surface contact log was maintained throughout their watch, but a Surface Contact Log was, in fact, not maintained for several days prior to the collision.

Furthermore, the Digital Dead Reckoning Trace plot was not in use at the time of the collision. In every mishap, a combination of seemingly minor departures from procedures or practices was deemed to have been contributory or directly causal to the final mishap chain. These departures constitute organizational drift and reflect the long cultivation period of the mishaps.

8.2.2 Human Performance Factors

With a high pace of operations, forward leaning teams can fail to recognize when human performance limits are reached. Outward focus on mission can stifle acknowledgement of fatigue preventing good decision making by individuals or teams. The mishaps highlighted the belief that operating at a high pace builds the proficiency that will overcome attendant risks and ignored four other critical factors: fatigue, crew endurance, performance and feedback.

Fatigue

Fatigue or ineffective fatigue/rest management was embedded in the four key mishaps that occurred in the Western Pacific. For example, in the mishap involving USS Fitzgerald, liberty expired at 0600 for all hands, followed by a full schedule of demanding evolutions that left the 2200-0200 watch section fatigued and without adequate rest. Similarly, USS Antietam watchstanders on the Bridge and Forecastle reported “fair” to “poor” sleep quality as they transitioned from an ashore to at-sea watch scheme. Witnesses on USS John S. McCain cited fatigue, even exhaustion, as having a negative impact on morale. This ship did not use a static, circadian rhythm watchbill. On the other hand, in the case of USS Lake Champlain, the ship did employ a circadian rhythm-conducive watchbill, but they did not support that watchbill with an effective ship’s routine.

Recent surface forces guidance on fatigue management requires further refinement and expansion to all ships at all times. Circadian rhythm watchbills alone are not enough (e.g., 12 on 12 off is circadian, but does not account for administrative work after watch), and any circadian rhythm watchbill scheme without a supporting ship’s routine is also ineffective. The crew will not experience the long term benefits

(improved crew endurance) of the concept unless the ship's routine supports the static watch rotation. For example, the inherent value of the 3-and-9, 4-and-8 or 6-and-18 watch rotations supports fatigue recovery (e.g., sleep quality with the opportunity for 8 hours of uninterrupted sleep) and crew endurance. Crew endurance is the ability to maintain optimal warfighting performance while enduring job-related physical, psychological, and environmental challenges.

Endurance

Operational effectiveness depends on crew endurance. If crewmembers are overly fatigued, mission accomplishment, performance, and safety are in jeopardy. Chronic sleep debt has long-term physical and mental health consequences and degrades human performance. Overall, the command's ability to identify fatigue factors early, effectively implement a circadian rhythm watch bill with corresponding special evolution watch bills, and a supporting ship routine will optimize fatigue recovery and crew endurance.

The USCG has developed the Crew Endurance Management System (CEMS) which is a set of tools and practices maritime operators can use to manage productivity and safety levels in their operations. CEMS specifically helps operators identify the operational risk factors affecting crew endurance in particular situations, and to control these risk factors by means of proven practices and procedures. This guide is specifically intended to help maritime operators maximize crew performance and safety by identifying and controlling factors affecting crew endurance in normal operations.

Performance

Additionally, with respect to watchteam performance, resilience, and operational safety, there is strong Defense Equal Opportunity Management Institute (DEOMI) survey evidence that forward deployed operational readiness overall is affected by fatigue and stress. DEOMI survey results from forward deployed ships showed relevant recurrent themes regarding exhaustion, high stress, and lack of sleep. These negative indicators appear on 21 of the 22 ships based in Japan.

Manning shortfalls can contribute to crew fatigue and crew endurance. For example, manning shortfalls of 15-20 percent exist within particular enlisted ratings on some classes of ships. This gap, coupled with high operational tempo, impacts the command's ability to train and sustain individual tempo for the Sailors if they are still trying to meet operational and training expectations of a fully manned ship, often at the expense of sleep. Consistent with civilian requirements, the Navy Standard Work Week assumes 13 hours per day for Sailors on operational ships. However, survey data indicates personnel working significantly longer hours.

As evident in the recent analysis of the Navy Standard Work Week (NSWW), typical on-duty hours exceeded the planning threshold factor of 15 percent. In other words, Service Diversion (e.g. quarters, inspections, sick call or non-training-related assemblies) exceeded the NSWW planning factor by 64 percent, training and drills exceeded by 58 percent and watchstanding exceeded by 29 percent. Naturally all categories of Off-Duty Hours were under the NSWW planning factors. Time spent eating was under executed by 37 percent, personal and Sunday time was short by 51 percent and sleep was short by 28 percent. The execution of the NSWW, especially in the lens of manning shortfalls, stifles fatigue recovery and crew endurance.

In light of the above, the Navy has recently completed the first part of a DDG Class inport work week study. Because there are multiple variants of the DDG Class destroyer, there are seven different Ship Manpower Documents (SMD) that display the minimum manpower required to achieve readiness and meet ships' anticipated workloads. As of October 2017, the Navy has completed review of one of seven DDG Class SMDs. The initial results indicate more enlisted Sailors will be needed to achieve minimum readiness standards.

Some solutions to manning shortfalls cause their own secondary problems. Since 1 May 2017, 49 Sailors in certain ratings on ships executing a maintenance period (e.g., Operations Specialist, Search and Rescue swimmer) have been temporarily assigned to other deploying Japan-based ships. Many of these deploying ships would not have met the requirements to deploy without the temporarily assigned critical skill sailor. Pulling Sailors from inport ships and placing them on deploying ones reduces or eliminates time to complete school or training for that Sailor, and denies

opportunities for longer term fatigue recovery. Additionally, this practice reduces the overall number of Sailors remaining on the inport ship to complete daily tasks and places additional stress on affected Sailors and families.

Human performance in service of the Navy mission is rich in inherent complexity, due to the nature of operations and the extreme environments and conditions in which work is performed. High-stakes, high-demand, high-tempo operations in a challenging maritime environment provide various opportunities for errors and undesirable outcomes which can manifest themselves in many different ways, but the driving forces behind these incidents are rarely unique. Error is a result of some causal factor, or more likely factors that impeded human performance. These factors could be: environmental, like fog that degraded visual perception or a noisy workspace that muddled communication; cultural, like poor housekeeping practices or low watchstanding standards; team-related, like inadequate team communication or a lack of a shared mental model; or individual, like a lack of a questioning attitude, physical or cognitive fatigue, or poor risk assessment. The confluence of factors produces an error, which in turn may have consequences in the form of an incident or near miss event. It is important to look at the causal factors that contribute to near miss events, as they are likely to be the same factors that could have contributed to more serious accidents.

Improved training can help overcome human performance weaknesses. Previous successes with the legacy approach for simulator employment should be leveraged with emerging and innovative strategies in order to learn more effectively as part of a deliberate learning curriculum. Further, a need exists to ensure training and operational interfaces are consistent to support better transfer of training and more valid assessments in simulator environments.

Feedback

The Review Team met with experts in the field of training and simulation, including government and contract providers, and NASA Langley Research Laboratory Crew Systems and Aviation Branch scientists (developing new ways to sense and categorize psycho-physiological responses to improve human performance). Simulations can directly improve two observed shortcomings in current surface training: team effectiveness; and individual performance in the use of specific equipment such as

VMS, Surface Search Radars, and AIS to build situational awareness. Current training programs are ineffective in addressing either shortcoming. To become effective, the Navy must develop training models in a structured way, and then deliberately develop simulators and task-trainers to match that model.

The realism, rapidity, and immediate feedback of the technology discussed above will further enhance the implementation of the PBED process in line with central tenets of learning. This will improve the surface community's approach to analyze discrete events and discuss improvements among the watchstanders and the team in real time. This will also normalize the inherent variability associated with inconsistent shipboard operational experiences.

Experiences in this training environment must include effective assessment of performance to build confidence and a willingness of junior officers and sailors to provide forceful backup to the team. Watch teams must continually apply the best concepts, techniques and technologies to accelerate learning as individuals, teams and organizations.

8.2.3 "Can do" Culture

Whether called "can do" or "mission first," the surface force is culturally oriented to accomplish whatever task it is given. When this attitude is self-inspired, remarkable results can be, and have been, achieved. We value this culture, because the Navy needs leaders who can confidently manage their ships and crews as well as their operational risks. But can-do should never mean must-do. So, we must continue to encourage our Commanders to accept the risks when the benefit to be gained is worth the potential risk of failure. The manifestation of that culture in a unit, or headquarters, is highly dependent on the experience and temperament of individual leaders. And, as outlined in this report's analysis of managing the supply and demand of surface forces, the effectiveness of systems in place to prevent overstressing of individuals or units varies.

Under pressure to perform, and feeling ill-equipped to succeed, some leaders can stop listening to their team when feedback appears to detract from their immediate goals. Interviews revealed that, particularly among ships based in Japan, crews

perceived their Commanding Officer was unable to say "no" regardless of unit-level consequence. Tight directive control can result in a command climate intolerant of dissenting views or questions that prevents effective teamwork and forceful feedback in planning, preparations, and execution.

The perceived uniqueness of Japan-based ships is significant in two ways: (1) the formalized and approved model for the training and certification of forces in Japan was overtaken by the increases in operating tempo; and (2) there was no separation between responsibilities for producing ready forces and employing those forces to meet mission demands. These differences made Japan-based ships fragile relative to other fleets where there are structural checks in place against unidentified drifts in training and certification readiness. By routinely employing forces that do not meet full readiness standards (e.g., 84 training events for Japan-based ships were cancelled due to operational demands), leadership marginalized the standard, and in turn degraded the training and certification process, resulting in increased risk to the FDNF-Japan surface force. Consequently, the rigor in conducting risk-to-force assessments was overshadowed by operational primacy, and led to only partially informed assessments, poor mitigation identification, and reduced ability to meet the mission.

Sailors take great pride in a "can do" attitude. Crews are safety conscious, but when it comes to assessing their own fatigue their perceptions tend to be reactive, often complacent and dominated by unsubstantiated optimism that motivation on caffeine can replicate the cognitive and physical prowess of a well-rested crew. While many warfighters believe and assert that fatigue can be overcome by motivation, adequate motivation can only moderate the deleterious effects of fatigue to a limited degree.

Motivation alone cannot compensate for the impact of sleep debt on performance levels, which have been found to decline as much as 30 percent after the first night of sleep deprivation, and up to 60 percent during the second night when sleep deprivation was combined with continuous cognitive tasks. When fatigue can impact operator performance and ship safety, sailors need to know when they must succumb to their own fatigue, be proactive about their fatigue management plan, and reach out to leadership.

8.2.4 Sustaining Change

Historically, the surface force unintentionally and unknowingly stopped short of institutionalizing changes or going after force-wide cultural issues that were resident in nearly all mishaps. A singularly focused program, such as the Fleet-wide Improvement and Operational Safety (FIOS) program, would have the bandwidth to build resilience by harvesting lessons learned across Navy platforms, sustaining improvement, and serving as an authoritative platform from which to drive widespread cultural change. One of the goals of this program would be to end the cycle leadership typically goes through following a major mishap: order an operational pause or safety stand down; assemble a team to determine what happened and why; and develop a list of discrete actions to get better. Like many times before, following this review, many causes will be identified, many meaningful actions will be taken, and there will likely be near-term success in getting things back on track. In reality, however, this may be chipping away at the margins. In the absence of an enduring program in place to prevent forgetting important lessons, systemic change and long lasting improvements may not occur.

The assessment of relevant risks in advance so that mitigations can be put in place to eliminate or minimize the hazard is essential to avoid major incidents. While it is, of course, critical to learn lessons from near-miss and mishap events with the aim of preventing future incidents, this approach is reactive and has the disadvantage that preventative measures may not be identified or taken until some mishap has occurred. A proactive approach using innovative analytic techniques that is responsive to identified trends in close calls supports the implementation of strategies, mitigations, and solutions without waiting for a precipitating untoward event.

Finally, each of the four Bridge and CIC teams involved in the mishaps did not work with each other to solve problems as an effective team. Standing on the Bridge together, all the watchstanders, and the CO, face the same problem. Successful teams will use their collective skills as a team to effectively use the methods and techniques best suited to their ship and the conditions at hand. A principle attribute of teamwork is forceful backup. The surface force must work to embrace a culture where the CO is not perceived as the single source for all answers. Watchstanders that are well trained, knowledgeable and proficient, each have a contribution to the success of the team.

Throughout their careers, Commanders and subordinates need to understand, develop and foster a climate which empowers all individuals to provide forceful backup.

The surface force has taken some positive steps in this regard, particularly with the development of the Naval Surface and Mine Warfighting Development Center (NSMWDC), a model that was adopted from effective programs in other communities. The Warfare Tactics Instructor (WTI) program trains officers in warfighting doctrine and tactics to help crews achieve tactical superiority, and as part of this, empowers its WTIs with the knowledge and courage to be assertive with the crews they are training. Most of all, this program empowers junior officers with the knowledge and courage to provide forceful feedback to senior officers in order to help them learn how to become better tacticians and more effective warfighters and leaders.

This idea has broader applicability to watchstanders on the Bridge and in CIC. All watchstanders, from the most junior Sailor to the CO, have an obligation to use their voice to provide forceful backup when they see a deviation from procedure or dangerous situation developing. Command leadership, regardless of experience and rank, must have the humility to listen to the backup and consider it in their decisions. By example, this will encourage their subordinates to do the same.

Corrective actions in the surface force will be most effective when a culture of safety is backed by a culture of teamwork. When subordinates are routinely empowered to speak-up, they are also developing the courage that will be needed in situations of extremis, and when all levels of command are operating interdependently, with greater teamwork, and with a heightened awareness of the adequacies of their actions.

8.3 Recommendations

8.3.1 Critical Assessment

1. **Establish and utilize near miss reporting processes to share lessons across the surface force.** Implement a near miss/close call critique process to support identification and mitigation of underlying hazards and vulnerabilities that contribute to operational risk, including Human Factors analysis. [CNSF, on-going]
2. **Improve Navy Safety Center and fleet and force headquarters safety programs and data analysis to provide predictive operational safety and risk information.** [USFF/CPF/NSC/CNSF/CNAF/CSF/CNIF/NECC, 31Mar2018]

8.3.2 Human performance factors

1. Develop a plan to deliberately train and assess units under stress and fatigue conditions that implements risk controls during execution, and allows for recovery time afterward. [CNSF, 31Mar2018]
2. Leverage the Navy Leader Development Framework (NLDF) competency and character development continuum similar to reinforce team building, team leadership and team effectiveness in support of the six sound shipboard operating principles. [OPNAV, 31Mar2018]
3. Based on the results to date from the study of DDG manning requirements, conduct a pilot to supplement manning on one unit in basic phase and validate expected improvements in individual workloads. A unit in a similar basic-phase schedule should be used for comparison. [CNP/CNSF, 31Mar2018]

8.3.3 “Can do” culture

1. **Establish a comprehensive fatigue and endurance management policy to implement fatigue recovery standards and codify a circadian ship and watch rotation routine for surface ships.** Include in this policy an implementation plan (similar to the USCG Crew Endurance Management Program) which considers human factors and delineates operational restrictions to include “Go-No-Go” criteria for hours on task, and task limitations. [CNSF, 30Nov2017]
2. Establish mental health evaluation support at the waterfront in all fleet concentration areas. [CNSF, 31Mar2018]

8.3.4 Sustaining change

1. Establish human performance expertise at all Type Commander staffs.

Incorporate a human factors expert permanently on Echelon III staffs to institutionalize the Fleet Improvement and Operational Safety (FIOS) program and integrate it with the existing Afloat Safety Program. [OPNAV/USFF/CPF, 30Sep2018]

2. Establish Commanding Officer mentors in surface ship homeports. Assign senior mentors with proven at sea leadership experience to develop leadership skills and improve organizational capacity. The key components of this mentorship program will focus on seamanship and navigation, team building and operational safety.
[CNSF, 31Mar2018]

3. Review the Overseas Screening, Sea Duty Screening, Overseas Tours Extension Incentives Program (OTEIP) and Exceptional Family Member programs to improve mitigation to manning assignments for all forward-deployed ships and squadrons.
[CNP, 31Mar2018]

9. APPENDICES

9.1 Summary of Recommendations

4.3.1 Individual Training

1. **Create an objective, standardized assessment program to periodically assess individual seamanship and navigation skills over the course of a Surface Warfare Officer's career.** This process should be informed by the MITAGS Navigation Skills Assessment Program (NSAP) principles to assess Surface Warfare Officer seamanship and navigation skills at every career milestone, including an objective assessment by SWOS prior to initial qualification as Officer of the Deck. [NETC, 31Mar2018]
2. **Improve seamanship and navigation individual skills training for Surface Warfare Officer candidates, Surface Warfare Officers, Quartermasters and Operations Specialists.** This effort should include at a minimum updating the curricula (content and durations) for Surface Warfare Officers, Quartermasters, Operations Specialists, and Electronics Technicians, for all career milestones from new accession to major command (for officers) or master-level (for enlisted). [NETC, 31Mar2018]
3. **Improve Operational Risk Management training and education at all Surface Warfare Officer School milestone courses.** [NETC, 31Mar2018]
4. Provide additional fundamentals training for officers who qualified SWO without initial classroom training (e.g., SWOSDOC or B/ADOC) covering Automated RADAR Plotting Aid (ARPA), Electronic Chart Display and Information System (ECDIS), and Automatic Information System (AIS). [NETC/CNSF, 31Mar2018]
5. Update the Surface Warfare Officer Requirements Document to capture the metrics used to evaluate seamanship and navigation skills in Surface Warfare seamanship safety assessments. [CNSF, 31Mar2018]
6. Incorporate fatigue, crew endurance, and stress management into appropriate career milestone Surface Warfare Officer training and enlisted leadership courses. [NETC, 31Mar2018]
7. Evaluate use of Yard Patrol craft in all officer accession programs. The study should include the feasibility of expanding Yard Patrol craft use, and other training methods, so that every naval officer receives core competencies as articulated in the Officer Professional Core Competencies Manual. [USNA/NETC/CNSF, 30Sep2018]

8. Update Personnel Qualification Standards for Bridge and CIC watchstations including actions to address current navigation tools, surface search radars, ship control systems, and team performance related to navigation and contact management and avoidance. [NETC, 31Dec2017]
9. Revise the Surface Force Readiness Manual to define the Officer of the Deck requalification process and circumstances under which watchstanders requalify on their current platform due to configuration changes. [CNSF, 31Mar2018]

4.3.2 Officer Career Path

1. Align the number of SWO candidates assigned to ships with the billet requirements. [CNP, 31Mar2018]
2. Evaluate the SWO career path from accession to major command including the scope and timing of formal training, sea/shore assignments, and Executive Officer and Commanding Officer sequence and timing. This evaluation should also incorporate a process to ensure an appropriate talent distribution of SWO candidates to the fleet in their first sea duty assignment. [CNP, 30Sep2018]
3. Establish a single, longer division officer tour as the standard, with allowances for specific billet requirements. Emphasize that the focus of division officer tours should be building proficiency, especially in seamanship and navigation. [CNP, 31Mar2018]
4. Establish policy to define, maintain, and reestablish SWO currency (e.g., a Bridge log) that accounts for Surface Warfare Officer OOD, JOOD, and Conning Officer watchstations. [CNSF, 31Dec2017]

5.3 Unit Training

1. **Improve current seamanship and navigation team training and certifications to include assessment in high shipping density, emergency and in extremis environments.** This action should include establishing the curriculum to evaluate Bridge and CIC teams' ability to respond to navigation and shiphandling scenarios in accordance with the *Nautical Rules* for non-standard and emergency situations, including in extremis. [NETC/CNSF, 31Mar2018]
2. **Improve shore-based Bridge trainers and add CIC functionality to team training facilities.** Establish the requirement to include all watchstations associated with safe navigation in team trainers and determine any facility modifications or upgrades necessary to accomplish the integrated training. Leverage outside expert organizations (e.g., NASA Langley Research Laboratory, Crew Systems and

Aviation Branch) to independently assess and recommend improvements to the simulator training strategy. [CNSF/NETC/OPNAV, 31Mar2018]

3. Improve current seamanship (MOB-S) and navigation (MOB-N) team training and certifications to include assessment of Bridge-CIC team performance up to and including the Commanding Officer. [CNSF, 31Mar2018]
4. **Integrate Bridge and CIC evaluations for unit level seamanship and navigation training in shore-based team trainers, and during at sea training and certifications events.** Commanding Officers shall be required to attend, and scenarios shall focus on high-density traffic transits. [CNSF/NETC, 31Mar2018]
5. Recertify Bridge Resource Management training in the fleet concentration areas' Navigation Seamanship and Shiphandling Trainers to USCG standards. [NETC, 31Mar2018]
6. Implement a plan for all ISICs to evaluate the proficiency of the ships and crews to safely navigate in high-density traffic transits in the NSST as part of their ISIC navigation check ride after extended maintenance and before deployment. [CNSF, 31Dec2017]
7. Revise the NAVDORM to establish the SUWC as the primary surface contact management and contact avoidance watch station in CIC and establish formal SUWC training. [CNSP/CNSL/CNAP/CNAL/NETC, 31Mar2018]

6.3.1 Force Generation

1. **Develop a force generation model for ships based in Japan that addresses the increasing operational requirements, preserves sufficient maintenance and training time, and improves certification accomplishment.** [CPF, 31Dec2017]
2. **Conduct comprehensive Ready for Sea Assessments to determine the material and operating readiness for all Japan-based ships.** [CNSF, on-going]
3. **Permanently establish Naval Surface Group Western Pacific as an Echelon IV, Immediate Superior in Command administrative headquarters responsible for maintaining, training, and certifying FDNF Japan ships.** Evaluate establishing a similar activity in Rota, Spain and Everett, Washington. [CPF/USFF/CNSF/CNSL/C6F, ongoing]
4. **Cancel all existing Risk Assessment Mitigation Plans until all Ready for Sea Assessments are complete.** [CPF Immediate]

5. Evaluate the utility of the RAMP process as a risk management tool and make changes as appropriate. [CPF, 31Dec2017]
6. Evaluate and recommend a maintenance and modernization scheme for all Yokosuka-based ships that takes into account the operational requirements, the training, SRF&JRMCM and industrial base capacity and make recommendations for improvement. [OPNAV/USFF/CPF/NAVSEA, 30Jun2018]
7. Evaluate the OPTEMPO requirements applicable for forward-deployed units and revise control measures to account for the unique operational cycles for FDNF. [OPNAV, 31Dec2017]
8. Evaluate the current alignment of SRF and JRMCM to Commander, U.S. Pacific Fleet and determine if changes in owner/operator structure are needed. [OPNAV/CPF/NAVSEA, 31Dec2017]

6.3.2 Force Employment

1. **Restore the SEVENTH FLEET deliberate employment scheduling process to improve operational planning and risk management.** [C7F/CPF, immediate]
2. **Establish formal policy for requalification requirements for personnel temporarily assigned to ships and when changes in equipment configuration occur.** [CNSF/CSF/CNAF, 30Nov2017]
3. **Establish a single Echelon II higher headquarters responsible for the readiness generation of all Navy forces.** [OPNAV/USFF/CPF, 30Sep2018]
4. Evaluate existing “redlines” policy with respect to navigation, RADAR, steering, and propulsion systems. [CNSF, 30Nov2017].
5. Improve the overseas and sea duty screening process to more rapidly identify those who will not screen for overseas and/or sea duty and to accelerate the process to identify replacement candidates. [CNP, 31Mar2018]
6. Evaluate all current operational requirements in the Western Pacific and prioritize operations with available resources. If assigned forces capacity is not sufficient to source the requirement utilize the Global Force Management process to request additional support. [C7F/CPF, 30Nov2017]

7.3 Seamanship and Navigation Equipment Readiness and Utility

1. **Consolidate responsibility and authority for Bridge system modernization and improve methods for human systems integration.** Establish a single authority responsible for all Bridge system operational requirements aligned with a single engineering authority responsible to the Navy for management of the Bridge and Combat Information Center systems as an integrated control room over the life of each ship class. [OPNAV/NAVSEA/PEO IWS, 31Mar2018]
2. **Accelerate plans to replace aging military surface search RADARs and electronic navigation systems.** Fully fund development and implementation of Next Generation Surface Search RADAR. [NAVSEA, 31Mar2018]
3. **Improve stand-alone commercial RADAR and situational awareness piloting equipment through rapid fleet acquisition for safe navigation.** Identify, acquire, install and provide the maintenance and training support, for an appropriately positioned common commercial RADAR system on all surface ships. Remove existing non-supported commercial RADARs and establish policy preventing installation of commercial sensors without authorization. [NAVSEA/CNSF, 31Mar2018]
4. **Perform a baseline review of all inspection, certification, assessment and assist visit requirements to ensure and reinforce unit readiness, unit self-sufficiency, and a culture of improvement.** The goal of this review should be to reduce the overall burden on ships by eliminating low value engagements and refocus remaining actions on validating unit readiness, unit self-sufficiency, and improvement. [CNSF/NAVSEA, 31Mar2018]
5. **Numbered Fleet Commanders establish appropriate policies for surface ships to actively transmit and use Automatic Identification Systems (AIS) when transiting high traffic areas.** Consider if similar guidance is needed for submarines. [C3F/C4F/C5F/C6F/C7F/CT80, immediate]
6. Share lessons learned and operational guidance from the on-going technical review of USS John S. McCain systems and procedures. [NAVSEA, 30Nov2017]
7. Immediately develop and release a fleet advisory on safe and effective operation for all variants of ship's steering systems in all modes of operation. [NAVSEA, immediate]

8. As an immediate aid to navigation, update AIS laptops or equip ships with hand-held electronic tools such as portable plot units with independent ECDIS and AIS. [CNSP/CNSL, 31Mar2018]
9. Accelerate plans to transition to ECDIS-N versions 9.4 and greater on all ships with hardware that secures its connection and allows full AIS integration. In the interim, NAVSEA and Type Commanders should jointly develop ship specific guidance on how to configure and operate ECDIS-N, RADARs, and AIS to maximize reliable situational awareness, reduce cyber vulnerability, and best meet the intent of IMO standards. [NAVSEA/PEO IWS, 30Nov2017]
10. Survey ships with integrated Bridge systems for feedback and lessons learned. [NAVSEA, 31Mar2018]
11. Conduct design and procedural reviews to reassess all variations of Bridge control systems in the fleet with focus on the complexity, suitability of human machine interfaces, and reliability of the underlying safety-critical control systems for thrust and steering. [NAVSEA, 31Mar2018]
12. Assess the alignment between foundational training for enlisted operators and technicians and the technology used in integrated Bridge system consoles to ensure operators can take appropriate actions in response to equipment casualties. [NAVSEA, 31Dec2017]
13. Develop standards for including human performance factors in reliability predictions for equipment modernization that increases automation. [NAVSEA, 31Mar2018]
14. Update and define the Bridge and CIC watchstation requirements during all operating conditions in the SORM, NAVDORM, and EDORM. [CNSF, 31Mar2018]

8.3.1 Critical Assessment

1. **Establish and utilize near miss reporting processes to share lessons across the surface force.** Implement a near miss/close call critique process to support identification and mitigation of underlying hazards and vulnerabilities that contribute to operational risk, including Human Factors analysis. [CNSF, on-going]
2. **Improve Navy Safety Center and fleet and force headquarters safety programs and data analysis to provide predictive operational safety and risk information.** [USFF/CPF/NSC/CNSF/CNAF/CSF/CNIF/NECC, 31Mar2018]

8.3.2 Human performance factors

1. Develop a plan to deliberately train and assess units under stress and fatigue conditions that implements risk controls during execution, and allows for recovery time afterward. [CNSF, 31Mar2018]
2. Leverage the Navy Leader Development Framework (NLDF) competency and character development continuum similar to reinforce team building, team leadership and team effectiveness in support of the six sound shipboard operating principles. [OPNAV, 31Mar2018]
3. Based on the results to date from the study of DDG manning requirements, conduct a pilot to supplement manning on one unit in basic phase and validate expected improvements in individual workloads. A unit in a similar basic-phase schedule should be used for comparison. [CNP/CNSF, 31Mar2018]

8.3.3 “Can do” culture

1. **Establish a comprehensive fatigue and endurance management policy to implement fatigue recovery standards and codify a circadian ship and watch rotation routine for surface ships.** Include in this policy an implementation plan (similar to the USCG Crew Endurance Management Program) which considers human factors and delineates operational restrictions to include “Go-No-Go” criteria for hours on task, and task limitations. [CNSF, 30Nov2017]
2. Establish mental health evaluation support at the waterfront in all fleet concentration areas. [CNSF, 31Mar2018]

8.3.4 Sustaining change

1. **Establish human performance expertise at all Type Commander staffs.** Incorporate a human factors expert permanently on Echelon III staffs to institutionalize the Fleet Improvement and Operational Safety (FIOS) program and integrate it with the existing Afloat Safety Program. [OPNAV/USFF/CPF, 30Sep2018]
2. Establish Commanding Officer mentors in surface ship homeports. Assign senior mentors with proven at sea leadership experience to develop leadership skills and improve organizational capacity. The key components of this mentorship program will focus on seamanship and navigation, team building and operational safety. [CNSF, 31Mar2018]

3. Review the Overseas Screening, Sea Duty Screening, Overseas Tours Extension Incentives Program (OTEIP) and Exceptional Family Member programs to improve mitigation to manning assignments for all forward-deployed ships and squadrons.
[CNP, 31Mar2018]

9.2 Matrix of Mishap Attributes

	USS John S. McCain (DDG 56)	USS Fitzgerald (DDG 62)	USS Lake Champlain (CG 57)	USS Antietam (CG 54)
Underway Time				X
NOT Fully Certified	X	X		X
Weather as Predicted	X	X	X	X
Entering/Leaving Port within prior 24 Hours	X	X		X
Poor Planning	X	X	X	X
CO/XO on Bridge	X			X
Bridge/CIC Comms Failure	X	X	X	X
Bridge-to-Bridge Comms Failure	X	X	X	N/A
Radar Improperly Tuned	X	X	X	X
SPY Radar Off	X	X		X
Lack of Training on VMS		X		X
Only Bridge using VMS	X	X		X
AIS Secondary System/Not Integrated	X	X	X	N/A
Formal Commands NOT Adhered to	X	X	X	X
Subpar Watchstanders (qualified, not proficient)	X	X	X	
No EXTREMIS Call	X	X	X	X
Tripwires Ignored/Not Realized	X	X	X	X
Quals: Sufficient vs. Proficient (watchbills)	X	X	X	
Plan Responsibility NOT Properly Known				X
Special Evolution	X			X
Lost Situational Awareness/Bubble	X	X	X	X
Significant Gap in Seamanship (CO)		X		X
Training Programs Ineffective	X	X	X	X

	USS John S. McCain (DDG 56)	USS Fitzgerald (DDG 62)	USS Lake Champlain (CG 57)	USS Antietam (CG 54)
NAV Team Proficiency	X	X		X
Fatigue/fatigue Management	X	X	X	X
Outdated CO Guidance	X	X		X
Failure to follow CO Standing Orders	X	X	X	X
Poor Watch Team Continuity	X	X	X	
Poor Log Keeping	X	X	X	X
Primary Cause: Human Error	X	X	X	X
PBED not adhered to	X	X	X	X
Lack of Communication between Bridge / CIC	X	X	X	X
Poor Self-Assessment and training	X	X	X	X

9.3 Commands and Organizations Visited by CRT

The Review Team visited the following locations or interviewed personnel assigned to the following commands:

- Baltimore, MD
 - Maritime Institute for Training and Graduate Studies
- Bremerton, WA
 - Afloat Training Group Pacific Northwest
- Dahlgren, VA
 - Center for Surface Combat Systems
- Great Lakes, IL
 - Center for Surface Combat Systems Unit
 - Surface Warfare Officers School Command Unit
- Manama, Bahrain
 - Commander, FIFTH Fleet
- Naples, Italy
 - Commander, SIXTH Fleet
- Newport, RI
 - Naval Leadership and Ethics Center
 - Surface Warfare Officers School Command
- Norfolk, VA
 - Antech Systems
 - Commander, United States Fleet Forces Command
 - Commander, Naval Surface Force Atlantic
 - President, Board of Inspection and Survey
 - Commander, Carrier Strike Group FOUR
 - Commander, Destroyer Squadron TWO TWO
 - Huntington Ingalls Industry
 - Naval Seamanship Shiphandling Trainer
 - Naval Surface Warfare Center – Corona
 - USS ARLEIGH BURKE (DDG 51)
 - USS MAHAN (DDG 72)
 - USS BULKELEY (DDG 84)
 - USS FORREST SHERMAN (DDG 98)

USS JASON S DUNHAM (DDG 109)
USS RAMAGE (DDG 61)
USS SAN JACINTO (CG 56)
USS TRUXTON (DDG 103)
USS GRAVELY (DDG 107)
USS WHIDBEY ISLAND (LSD 41)
USS FORT McHENRY (LSD 43)
Virginia Pilots Association
Commander, Afloat Training Group Atlantic
Afloat Training Group Norfolk
Center for Surface Combat Systems Detachment
Surface Warfare Officers School Command Detachment
Space and Naval Warfare Systems Center Atlantic

- Pearl Harbor, HI

Afloat Training Group Mid-Pacific
Commander, Destroyer Squadron THIRTY ONE
Commander, U.S. Pacific Fleet
Commander, Naval Surface Group Mid Pacific

- Philadelphia, PA

Naval Sea Systems Command

- San Diego, CA

Commander, THIRD Fleet
Commander, Naval Surface Force Pacific
Commander, Carrier Strike Group ONE
Commander, Carrier Strike Group ONE FIVE
Commander, Expeditionary Strike Group THREE
Commander, Destroyer Squadron ONE
Naval Seamanship Shiphandling Trainer
USS WAYNE E MEYER (DDG 108)
USS SOMERSET (LPD 25)
Commander, Afloat Training Group Pacific
Afloat Training Group San Diego
Center for Surface Combat Systems Detachment

- Sasebo, Japan

Commander, Expeditionary Strike Group SEVEN
Commander, Amphibious Squadron 11
Commander, Fleet Activities Sasebo
Commander, Mine Countermeasures Squadron SEVEN
Commander, Naval Ship Repair Facility

Naval Seamanship Shiphandling Trainer
USS BONHOMME RICHARD (LHD 6)
USS GREEN BAY (LPD 20)
USS PIONEER (MCM 9)
Afloat Training Group Western Pacific Detachment

- Washington, DC

Naval Sea Systems Command
Office of the Navigator of the Navy
Program Executive Office Integrated Warfare Systems
Space and Naval Warfare Systems Command

- Yokosuka, Japan

Commander, SEVENTH Fleet
Commander, Carrier Strike Group FIVE
Commander, Destroyer Squadron ONE FIVE
USS CHANCELLORSVILLE (CG 62)
USS STETHEM (DDG 63)
USS BARRY (DDG 52)
Afloat Training Group Western Pacific
U.S. Naval Ship Repair Facility, Yokosuka
Naval Surface Group Western Pacific

9.4 Comprehensive Review Team Members

Admiral Philip S. Davidson, Commander U.S. Fleet Forces Command

<u>Name</u>	<u>Affiliation</u>
VADM Richard P. Breckenridge, USN	U.S. Fleet Forces Command (USFF)
RADM Peter A. Gumataotao, USN	USFF/Naval Surface Force, Atlantic
CAPT Christopher W. Brunett, USN	USFF
CAPT Chris J. Bushnell, USN	Surface and Mine Warfare Development Center
CAPT David S. Deuel, USCG	Atlantic Area Command
CAPT Joseph Ring, USN	Destroyer Squadron THREE ONE
CAPT Kurt M. Sellerberg, USN	Naval Surface Force, Pacific
CAPT Melvin H. Underwood, CHC, USN	Submarine Force, Atlantic
CAPT David A. Welch, USN	OPNAV N3/N5
CDR H. Brendan Burke, JAGC, USN	Office of the Judge Advocate General
CDR Brent K. Faulkner, JAGC, USN	USFF
CDR Charles E. Hampton, USN	USFF
LtCol William D. Shannon, USMC	Marine Corps Forces Command
LCDR Owen B. Morrissey, SC, USN	USFF
LCDR Shelby M. Nikitin, USN	Navy Personnel Command
LCDR David C. Sandomir, USN	Naval Surface Force, Pacific
LT Heather P. Steele, USN	Afloat Training Group, Norfolk
LTJG Brian M. Herbert, USN	USS LABOON (DDG 58)
LTJG Trenton R. Layne, USN	USS TRUXTUN (DDG 103)
QMCM(SW) John C. Eskridge, USN	Transient Personnel Unit, Norfolk
OSC(SW) Terry P. Dehollander, USN	USFF
GSMC(SW) Tacito R. Reyes, USN	Assault Craft Unit FOUR
Dr. Jon A. Jones	Naval Sea Systems Command 08 (NAVSEA 08)
Mr. Stephen E. Fisher	NAVSEA 08
Mr. Russell T. Williams	USFF
Mr. William A. Walsh	NAVSEA
Mr. Peter W. D. Morford, PMP, CPLP	Afloat Training Group, Atlantic
Mr. Kevin J. Couch	Naval Surface Force, Pacific
Dr. Kimberly Culley	Submarine Force, Atlantic
Mr. Steven W. Holland	USFF
Captain David K. Murrin	USNS COMFORT (T-AH 20)
Mr. Mark E. Morrison	USFF
Dr. Daniel J. Whiteneck	Center for Naval Analyses

9.4.1 Independent Advisors

Name

ADM Bill Gortney, USN (Ret)
GEN Carter Ham, USA (Ret)
LtGen. John Sattler, USMC (Ret)
VADM Mike Connor, USN (Ret)
Captain Eric Nielson

Dr. Steven J. Spear

Affiliation

Highly Qualified Expert, Naval War College
Special Government Employee
Special Government Employee
Consultant, ThayerMahan, Inc.
Special Government Employee,
President of the Association of Maryland Pilots
Consultant, High Velocity Edge, LLC

9.5 References

American Bureau of Shipping, *Guidance Notes on Ergonomic Design of Navigation Bridges*, October 2003

Articles of the Convention on the International Regulations for Preventing Collisions at Sea (COLREGS), 1972

Button, R., Martin, B., Sollinger, J., & Tidwell, A., *Assessment of Surface Ship Maintenance Requirements*, Santa Monica, CA, RAND Corporation (2015)

Clark, B. & Sloman, J., *Deploying Beyond Their Means: America's Navy and Marine Corps at a Tipping Point*, Center for Strategic and Budgetary Assessments

COMNAVSEASCOM message 171339Z August 2016, SEA 21 Ship Program Manager (SPM) Policy for Chief of Naval Operations Availabilities for CRUDES and Amphibious Ships

COMNAVSEASCOM message 281449Z June 2016, SEA 21 Ship Program Manager (SPM) Policy for the Late Add Process in CNO Availabilities for CRUDES and Amphibious Ships

COMNAVSURFOR Instruction 1412.4, Surface Warfare Officer Requirements Document, 23 March 2017

COMNAVSURFOR message 160050Z September 2017, COMNAVSURFOR Warfighting Serial 13-Confidence and Competence

COMNAVSURFPAC Instruction 4700.IB/COMNAVSURFLANT Instruction 4700.IB/CNRMCI Instruction 4700.7A, Total Ship Readiness Assessment Visit Program

COMNAVSURFPAC Instruction 5450.37F, Mission, Functions and Tasks of Commander, Naval Surface Group, Middle Pacific, 23 January 2017

COMNAVSURFPAC Instruction/COMNAVSURFLANT Instruction 3505.1A, Navigation Seamanship and Ship-Handling Training, 12 December 2016

COMNAVSURFPAC/COMNAVAIRPAC/COMNAVAIRLANT/COMNAVSURFLANT Instruction 3530.4E, Surface Ship Navigation Department Organization and Regulations Manual, 31 October 2016

COMNAVSURFPAC/COMNAVAIRPAC/COMNAVAIRLANT/COMNAVSURLANT Instruction 3530.4D Appendix A, Squadron/Group Staff Navigation Assessment, 19 July 2013

COMNAVSURFPAC/COMNAVSURFLANT Instruction 3500.11A, Surface Force Exercise Manual, 30 November 2016

COMNAVSURFPAC/COMNAVSURFLANT Instruction 3502.3, Surface Force Readiness Manual, 9 March 2012

COMNAVSURFPAC/COMNAVSURFLANT Instruction 3502.3, Surface Force Readiness Manual, 30 November 2016

COMPACFLT/COMUSFLTFORCOM Instruction 3501.3D, Fleet Training Continuum Instruction, 1 October 2012

COMSC Instruction 3121.9C, Standard Operating Manual, 12 September 2012

COMSC Instruction 3501.4A, T-AO Single Hull Tanker Risk Mitigation Program

COMSC Instruction 3530.1, Military Sealift Command Navigation Policy, 18 October 2016

COMSC Instruction 4490.1, Original Equipment Manufacturers and Non-Original Equipment Manufacturers Use Policy, 10 April 2017

COMSC Instruction 9670.1G, Allowance of Electronic Equipment for MSC Ships, 6 March 1995

COMSEVENTHFLT Instruction 3501.1B, Seventh Fleet Training Program, 11 October 2012

COMTHIRDFLT Instruction 3501.1, Integrated and Advanced Fleet Training Instruction, 25 September 2013

COMTHIRDFLT Instruction/I MEFO 3502.1, Amphibious Ready Group Fleet Response Training Plan and Marine Expeditionary Unit Pre-Deployment Training Program

COMUSFLTFORCOM message 051931Z August 2010, CSG-ESG Commander and Type Commander Command relationships

COMUSFLTFORCOM/COMPACFLT Instruction 3000.15A, Optimized Fleet Response Plan, 8 December 2014

COMUSFLTFORCOM/COMPACFLT Instruction 3000.16, Fleet Inspections, Certifications, Assessments and Visits Program and Processes, 17 February 2016

COMUSFLTFORCOM/COMPACFLT Instruction 3501.3D, Fleet Training Continuum

Culley, K. & Madhavan P., *Trust in automation and automation designers: Implications for HCI and HMI*. COMPUTERS IN HUMAN BEHAVIOR, 29, 2208–2210, (2013)

Department of Defense Design Criteria Standard: Human Engineering, MIL-STD-1472G, 11 January 12

Det Norske Veritas Part 4 Chapter 11: Safety of Navigation

*Germanischer Lloyd Rules for Classification and Construction Ship Technology:
Seagoing Ships – Bridge Arrangement and Equipment on Seagoing Ships 2012*

IMO Maritime Safety Committee Resolution A.817 (19), Performance Standards for Electronic Chart Display and Information Systems

IMO Resolution A.819 (19), Performance Standards for Shipborne Global Positioning System Receiver Equipment, 15 December 95

IMO Resolution A.893 (21), Guidelines for Voyage Planning, 4 February 00

IMO Resolution A.916 (22), Guidelines for the Recording of Events Related to Navigation, 22 January 02

MITAGS-PMI Quick Reference Guide to the Implementation of the STCW Manila Amendments, 2010 and the USCG Final Rules

MITAGS-PMI Simulation Capabilities and Facilities Guide, April 2017

MITAGS-PMI Training Requirements for Various Merchant Mariner Billets, 25 September 17

NAVEDTRA 43101-3F, Personnel Qualification Standards, Surface Warfare Officer Engineering

NAVEDTRA 43101-4F, Personnel Qualification Standards, Surface Warfare Officer Combat Information Center Watch Officer, Officer Of The Deck Underway, Officer Of The Deck Underway Platform Endorsement,

NAVEDTRA 43304-E, Personnel Qualification Standards, Tactical Action Officer

NAVEDTRA 43398-13B, Personnel Qualification Standards, Aegis Combat Information Center Supervisor, Aegis Piloting Officer, Aegis Shipping Officer, Aegis Surface Detector/Tracker and Radar Controller, Aegis Surface Subsurface Supervisor/Surface Subsurface Warfare Supervisor,

NAVEDTRA 43398-14B, Personnel Qualification Standards, Aegis Surface Warfare Coordinator, Aegis Weapons System Warfare Coordinator

NAVEDTRA 43492-2J, Personnel Qualification Standards, Ship's Control and Navigation

NAVMED P-6410, Performance Maintenance during Continuous Flight Operations, 1 January 2000

NAVPERS 18068-32J CH-64, CHAPTER 32: Electronics Technician (ET), October 2015

NAVPERS 18068-59G CH-68, CHAPTER 59: Operations Specialist (OS), October 2016

NAVPERS 18068-66E CH-67, CHAPTER 66: Quartermaster (QM), July 2016

NAVSEA INSTRUCTION 2319.2, NAVSEA Advisory Program, 17 Ju1 2015

NAVSEA INSTRUCTION 5400.1F, Naval Sea Systems Command Organization Manual, 26 August 2013

NAVSEA Instruction 9420.4A, Certification of Navigation Systems, 2 October 2009

Norris, G., & Wagner, M., *Boeing 777: The Technological Marvel*, Minneapolis, MN, MBI Publishing (2001)

OPNAV Instruction 1500.57C, Surface and Expeditionary Warfare Training Strategy, 19 February 2013

OPNAV Instruction 1500.76C, Naval Training Systems Requirements, Acquisition, and Management, 14 August 2013

OPNAV Instruction 3000.15A, Optimized Fleet Response Plan, 10 November 2014

OPNAV Instruction 3120.32D, Standard Organization and Regulations Manual, 16 July 2012

OPNAV Instruction 4700.7L, Maintenance Policy for United States Navy Ships, 25 May 2010

OPNAV Instruction 5400.45, Standard Navy Distribution List, 1 October 2017

OPNAV Instruction 9420.1B, Positioning, Navigation and Timing Policy; Administration and Planning, 29 June 2007

OPNAV Instruction 9420.2, Implementation of the Electronic Chart Display and Information System-Navy (ECDIS-N) Certification Process, 15 February 2001

OPNAV Instruction 9420.2A, Navy Electronic Chart Display and Information System Policy and Standards, 31 October 2014

Parasuraman, R. & Riley, V., *Humans and automation: Use, misuse, disuse, abuse*, HUMAN FACTORS, 39, 230-253 (1997)

Safer Seas Digest: Lessons Learned from Marine Accident Investigations, National Transportation Safety Board, 2016

Sarter, N. B. & Woods, D. D., *How in the world did we ever get into that mode? Mode error and awareness in supervisory control*, HUMAN FACTORS, 37(1), 5-19 (1995)

SECNAV Instruction 5400.15C CH-1, Department of the Navy Research and Development, Acquisition, Associated Life-Cycle Management, and Logistics Responsibilities and Accountability, 2 December 2011

U.S. Coast Guard, COMDTINST M3530.2E, Coast Guard Navigation Standards Manual, 10 March 2016

U.S. Coast Guard, Navigation and Vessel Inspection Circular No. 02-03, Carriage of Navigation Equipment by Ships on International Voyages, 4 June 2003

U.S. Coast Guard, Navigation and Vessel Inspection Circular No. 4-89, Introduction to Human Factors Engineering, 27 November 1989

U.S. Coast Guard, Navigation Rules and Regulations Handbook, August 2014

U.S. Naval Academy, Naval Service Training Command, Officer Professional Core Competencies Manual, August 2015

U.S. Nuclear Regulatory Commission, NUREG/CR-6635, Soft Controls: Technical Basis and Human Factors Review Guidance, March 2000

U.S. Nuclear Regulatory Commission, NUREG-0700 Rev 2, Human-Systems Interface Design Review Guidelines, May 2002

9.6 Acronyms

1/AE	First Assistant Engineer
1/O	First Officer
2/AE	Second Assistant Engineer
2/O	Second Officer
3/AE	Third Assistant Engineer
3/O	Third Officer
3M	Maintenance and Material Management
ABS	Able Bodied Seaman
ADOC	Advanced Division Officer Course
ASA	Afloat Safety Assessment
AIS	Automatic Identification System
AMHS	Automated Message Handling System
ARPA	Automatic Radar Plotting Aid
ASTAC	Anti-Submarine Warfare Tactical Air Controller
ATD	Aviation Training Devices
ATFP	Anti-Terrorism, Force Protection
ATG	Afloat Training Group
ATO	Anti-Terrorism Officer
ATP	Airline Transport Pilot
BDOC	Basic Division Officer Course
BMOW	Boatswain's Mate of the Watch
BRM	Bridge Resource Management
BTB	Bridge-to-Bridge
C4I	Command, Control, Communications, Computers and Intelligence
CASREP	Casualty Report
CAST	Computer Aided Submode Training
CBT	Computer Based Training
CDO	Command Duty Officer
CE	Certification Event
CEM	Crew Endurance Management
CFR	Code of Federal Regulations
CHENG	Chief Engineer
CIC	Combat Information Center
CICO	Combat Information Center Officer
CICWO	Combat Information Center Watch Officer
CICWS	Combat Information Center Watch Supervisor
CMAV	Continuous Maintenance Availability
CNRMC	Commander, Naval Regional Maintenance Center
CNSL	Commander, Naval Surface Atlantic
CNSP	Commander, Naval Surface Pacific
CM	Continuous Maintenance
CMC	Command Master Chief
CNO	Chief of Naval Operations
CO	Commanding Officer

CONN	Conning Officer
CONM	Conning Officer Mentor
CONUS	Continental United States
COVE	Conning Officer virtual Environment
CPT	Cockpit Procedures Trainer
CTOS	Commercial, Over the Shelf
CPO	Chief Petty Officer
CSC	Combat Systems Coordinator
CSCS	Center for Surface Combat Systems
CSMP	Current Ship Maintenance Plan
CSO	Combat Systems Officer
CV	Certification Validation
DDRT	Digital Dead Reckoning Tracer
DFS	Departure from Specification
DRRS-N	Defense Readiness Reporting System-Navy
DWO	Deck Watch Officer
ECDIS	Electronic Chart Display and Information System
EOCC	Engineering Operator Casualty Control
EOOW	Engineering Officer of the Watch
EOT	Engine Order Telegraph
ET	Electrician's Mate
F2S	Forced to Source
FDNF	Forward Deployed Naval Forces
FFS	Full Flight Simulators
FN	Fireman
FOS	Feasibility of Support
FOST	Flag Officer Sea Training
FTA	Fleet Technical Assistance
FTD	Flight Training Devices
HELM SAFETY	Helm Safety Officer
HM&E	Hull, Mechanical, and Electrical
IAW	In Accordance With
IBS	Integrated Bridge Systems
ICAV	Inspection, Certification, and Assist Visit
IETM	Interactive Electronic Technical Manuals
IMO	International Maritime Organization
INSURV	Board of Inspection and Survey
IOMM&P	International Organization of Masters, Masters and Pilots
ISEA	In Service Engineering Activity
ISIC	Immediate Superior in Command
IVO	In Vicinity Of
JOOD	Junior Office of the Deck
JRMC	Japan Regional Maintenance Center
LCU	Landing Craft Unit
LCAC	Landing Craft Air Cushion
LEE HELM	Lee Helmsman

LOK	Level-of-Knowledge
LOS	Loss of Steering
LPO	Leading Petty Officer
MASTER	Ship's Master
MASTER HELM	Master Helmsman
MITAGS	Maritime Institute of Technology and Advanced Studies
MLC	Master Labor Contract
MOC	Maritime Operations Center
MOQ	Mate of the Watch
MSC	Military Sealift Command
MSFSC	Military Sealift Fleet Support Command
MTE	Man, Train and Equip
NATO	North American treaty Organization
NAV	Navigator
NAVCERT	Navigation Certification
NAVIC	Navigation and Vessel Inspection Circular
NAVMAC	Navy Manpower and Analysis Center
NEC	Navy Enlisted Classification Code
NETC	Naval Education and training Command
NOBC	Naval Officer Billet Code
NSAP	Navigation Skills Assessment Program
NSTM	Naval Ship's Technical Manual
NSST	Navigation Seamanship and Shiphandling Trainer
NSSTRD	Navigation, Seamanship, and Shiphandling Training Requirements Document
NSWC	Naval Surface Warfare Center
NTTP	Navy Tactics, Techniques, and Procedures
NTSP	Navy Training System Plans
NUC	Not Under Command
NVG	Night Vision Goggles
OCNW	Officer in Charge of a Navigation Watch
OCONUS	Outside Continental United States
OFRP	Optimized Fleet Response Plan
OIC	Officer in Charge
OJT	On the Job Training
OOD	Officer of the Deck
OPS/INTEL	Operations/Intelligence
OPTEMPO	Operational Tempo
OS	Operations Specialist
OSS	Optical Sight System
PCC	Post Command Commander
PCO	Prospective Commanding Officer
PMS	Planned Maintenance System
POA&M	Plan of Action and Milestones
POT	Propeller Order Telegraph
PQS	Personnel Qualification Standard

PXO	Prospective Executive Officer
QM	Quartermaster
QMOW	Quartermaster of the Watch
RAS	Replenishment at Sea
R-COP	Readiness Common Operating Picture
RDZV	Rendezvous
RMC	Regional Maintenance Center
RMD	Restricted Maneuvering Doctrine
ROR	Rules of the Road (COMDTINST M16672.2D)
RSC	RADAR System Controller
S2E	Sailor to Engineer
SAB	Standard Answer Books
SITREP	Safety Investigation Report
SME	Subject Matter Expert
SMWDC	Naval Surface and Mine Warfare Development Center
SN	Seaman
SRA	Selected Restricted Availability
SOP	Standard Operating Procedure
SSDS	Ships Self Defense System
SSOP	Sound Shipboard Operating Procedures
STCW	Standards of Training, Certification and Watchkeeping
SUBFOR	Submarine Force
SURFOR	Surface Force
SUWC	Surface Warfare Coordinator
SWO	Surface Warfare Officer
SWOS	Surface Warfare Officer School
TACCOM	Tactical Communicator
TAO	Tactical Actions Officer
TASKORD	Task Order
TLO	Training Liaison Officer
TMI	The Type Commander Material Inspection
TRAV	Training Availability
TSC	Theater Security Cooperation
TSO	Temporary Standing Order
TSRA	Total Ship Readiness Assessment
TYCOM	Type Commander
UIC	Unit Identification Code
U/I	Under Instruction
UNK	Unknown
USCG	U.S. Coast Guard
USN	United States Navy
USSF	U.S. Fleet Forces
VMS	Voyage Management System
WOO	Windows of Opportunity
WTI	Warfare Tactics Instructor
XO	Executive Officer

9.7 VADM (Ret) Balisle Fleet Review Panel Summary and Recommendations

In support of this comprehensive review, the Navy provided an update on actions taken as a result of other reviews performed over the past eight years related to Navy readiness. The matrices in this enclosure supply the update for actions related to the 2009 Fleet Review. The Review Team concludes the actions described herein have at least been partially effective in creating a lasting change. While many factors affect the ability to sustain improvements, including budgetary constraints and world events affecting the demand for Naval forces, this Review Team did not attempt to perform a more detailed review of the specific actions related to previous reports. Some findings and recommendations for improvement detailed in this report align with previous reviews.

Recommendations	Steps/Actions taken (e.g. policies implemented, signed instructions, etc.)	Results and/or impacts of steps/actions taken (where applicable)
<p>3.2(a)-Implement a recurring, notional third party assessment, audit, and certification process integrated into the FRTP cycle as presented in Figure 3.3-5. See Section 5.2 of this report for a detailed explanation of a newer-term assessment process to quickly improve INSURV performance</p>	<p>Figure 3.3-5 is dated. FRTP (27-32 month) has been replaced by 36 month OFRP. CSG and ESG are the "readiness ISIC" referred to in the Balisle Report</p>	<p>The Balisle Report notes the number of failed INSURV inspections as a metric. The Board no longer provides Pass/Fail grading criteria, using instead IFOM as a more granular measurement. In order to conduct a better comparison to the metrics in the Balisle Report, the percentage of Satisfactory (>0.80) scores in INSURV Functional Area EOCs is a reasonable substitute. For the period FY2007 to FY2010, only 55% of the nineteen (19) Functional Areas were graded as Satisfactory. For the period FY2011 to FY2016, 75% of Functional Areas were graded as Satisfactory</p> <p>-Results of third party assessments from FY2011 to FY2016 demonstrate that surface force material condition, as measured by INSURV Figure of Merit (IFOM), is essentially steady. IFOM is a number between 0.00 and 1.00 generated by taking a weighted average of INSURV Functional Area Equipment Operational Capability (EOC) scores. Hull Structure assessment compliance. Simply put, INSURV audits whether or not class maintenance tasks and assessments are properly conducted and appropriately documented in accordance with established periodicities.</p>
<p>3.3.2(b)-Increase ATG manning to support their portion of recommended third party assessments. ATG manning is addressed separately in this report in Section 3.4 (Manpower and Training)</p>	<p>USFF established minimum ATG manning target of 80% Fill</p>	<p>ATG Fill/Fit increased from 75% Fill in 2012 to 84% Fill as of Sep 2017</p>

Recommendations	Steps/Actions taken (e.g. policies implemented, signed instructions, etc.)	Results and/or impacts of steps/actions taken (where applicable)
3.3.2(c)-Use in-service engineering agent (ISEA) and multi-ship multi-option (MSMO) contractor assets to augment assessment teams. Use of MSMO in assessments including pre-INSURV assessments is also included in Section 5.2	ISEA and MSMO (Firm Fixed Pricing) requirements to supply the services of qualified on-site technical representatives and resources to accomplish Ship Assessments/Inspections have been added to the NAVSEA Standard Items	Continuous Maintenance Plan Task Backlog trend reflects an improving trend. A reduction from the highest level of approximately 6000 backlogged tasks (January 2014) to approximately 2000 backlogged tasks (February 2017) has been recognized
3.3.2(d)-Increase CMAV funding to optimize work loading during these critical, dedicated maintenance periods	Balisle Report surmised that the Navy had been underfunding and understated requirement for many years: Began fully recognizing ship maintenance requirements - 2010 - \$200M in buy down of 2011 requirement - 2011 ~\$400M in buy down of 2012 requirement) - ~\$500M increase in ship maintenance funding from FY10 to FY12 Increased Programmed requirements Increased execution year growth	Based on IFRR trend analysis from 2009 to 2017: - While the percentage of on-cost availabilities shows a steady decline since 2011, the most recent availability data indicates this decline may have been arrested - As of November 2015, decline in on-schedule availability completions appears to have bottomed out and the number of on-schedule completions has risen since March 2016
3.3.2(e)-Require certification of work completion for all availabilities: SURFMEPP for CNO availabilities and TYCOM/R-ISIC for CMAVs. Use availability completion certifications in concert with an expanded version of CNSF "redline" initiative	Per the JFFM REV C, CH-5, 3.6.8.1.2 (h), dated 11 Aug 16, the NSA Chief Engineer must certify all work tied to the Availability Completion Key Event per the Availability Work Certification process The JFFM REV C, CH-5, 3.6.8.1.2 (i), dated 11 Aug 16, incorporates the requirement for Minimum Equipment (Redlines) to be met and maintained for all Mission Areas at the End of Maintenance Phase as part of Availability Work Certification and Completion Requirements	JFFM Requirements have been established to ensure availability completion certifications are used with redline requirements.

Recommendations	Steps/Actions taken (e.g. policies implemented, signed instructions, etc.)	Results and/or impacts of steps/actions taken (where applicable)
3.3.2(f)-Extend CNO Availability lengths as recommended by CNSF letter dtd 25 August 2009	As recommended by the CNSF letter dtd 25 AUG 2009, the set restriction of 9 week pier and 12 week docking availabilities has been removed leading to increased availability time as reflected in the annual OPNAVNOTE 4700	Availability lengths vary today depending on Class Maintenance Plan (CMP) status. The lengths are generally set by the requirements in the SURFMEPP managed planning process
3.4.2(a)-Increase manpower of optimum manned ships and ATG immediately to 110% of current BA to compensate for the 8.4% perpetual loss of personnel	USFF advocated to restore end strength to ATG's and ships impacted by Optimal Manning shortfalls	Approximately 2200 End Strength restored to Optimal Manning shortfalls in POM-12 (DDG +1313, LHD +249, CG +375, LPD 17 +108, LSD 41 +168). Approximately 320 End Strength restored to ATGs in POM-12/ 13
3.4.2(b)-Initiate a study immediately to determine actual shipboard manning requirements based on "maintaining" the ship, in addition to watch standing and operational requirements. See more details and rough estimates in paragraph 3.4.1	NAVMAC's Fleet Manpower Requirements Determination (FMRD) model for developing Ship Manpower Documents (SMDs) has always included workload for "maintaining" the ship. The ship workload includes not only the Operational Manning (OM) (i.e. Watches), but Planned Maintenance (PM), Corrective Maintenance (CM), Facility Maintenance (FM), and the support/administrative workload assigned to the Own Unit Support (OUS) variable	NAVMAC continues to access and update Ship Manpower Documents on a periodic and regular basis. Additionally, OFRP has established manning requirements of 92% Fit and 95% Fill prior to beginning Basic Phase training
3.4.2(c)-Establish a coordinated Sea/Shore rotation strategy which provides targeted, career enhancing shore duty opportunities where craftsman's skills can be grown and developed. Leverage shore maintenance organizations, assessment teams, and advanced skills training staffs to size and shape technical skills capabilities across the Navy	USFF advocated for Investments in manpower at RMC's and other shore activities to provide warfighter support	Investments in manpower at RMC's have increased military end strength by 1,188 since 2010. Warfighting development centers were also implemented in 2014 that provided career enhancing opportunities across all warfare domains for enlisted personnel in operational and tactical expertise (Note: RMC Manning a topic at October FCRC)

Recommendations	Steps/Actions taken (e.g. policies implemented, signed instructions, etc.)	Results and/or impacts of steps/actions taken (where applicable)
<p>3.4.2(d)-Approve and provide 85% DNEC Fit requirement/Review Top Six Roll-Down criteria with surface technical ratings as first priority. Determine NEC attainment barriers (e.g. unrealistic rate requirement for attendance) and for each barrier, provide plan to mitigate. Include within the review the particular role and needs of ATGs</p>	<p>USFF Requested Review of Top Six Roll down. USFF directed Critical NEC (CNEC) thresholds in MCAF Directive 15-1 that correlated to the TYCOM DRRS-N requirements</p>	<p>Top Six Roll down reversed for earmarked supervisors at sea. Surface ship CNEC Fit increased from an average of 72% in 2012 to 81% in Sep 2017. Additionally, OFRP has established manning requirements of 92% Fit and 95% Fill prior to beginning Basic Phase training</p>

Recommendations	Steps/Actions taken (e.g. policies implemented, signed instructions, etc.)	Results and/or impacts of steps/actions taken (where applicable)
<p>3.4.2(e)-Expand skills level training in the A schools or create an augmenting training capability and capacity on the waterfront to improve A school graduate repair expertise. Either approach must enhance Sailor initial skill sets to allow apprentice level Sailors to participate sooner in activities supporting material readiness</p>	<p>Since inception of the Surface and Expeditionary Warfare Training Committee in 2010, \$280M has been invested in the restoration and modernization of Enlisted engineering training with the vast majority of investments targeting substantial improvements to Accession engineering training at Great Lakes and Journeyman-level maintenance training at both Great Lakes and at the Fleet Concentration Areas. To date (15 Sept 17), 45 new or substantially modernized engineering courses have been fielded with another 75 in development or planning with scheduled delivery dates by 2019. Fielded training has been dramatically modernized by the infusion of virtual world technology balanced by hands-on, live skill application. The NAVSEA PMS-339 sponsored Technical Training Audit program (TTAP) has audited over 60 HM&E courses of instruction and with PMS-339 resourcing has ensured current maintenance training matches current fleet systems configurations and remains technically accurate. Following the Balisle Report, NETC and its Learning Centers began an initiative to improve Accession Training by updating A and C school content and increasing the number of practical, lab-based learning objectives to achieve a better ratio of knowledge-based learning to performance-based learning. USFF N1 is coordinating with NETC to get specific actions and results at the individual learning centers over the 2010-present time period in response to the Balisle Report. Additionally, the Navy has recently initiated RRL in order to modernize existing Enlisted Accession training; this process will eventually expand to journeyman and supervisory level training</p>	<p>Engineering maintenance training has been substantially improved. When engineering training was assessed in 2012, or 43 of 134 existing courses of instruction or 32% fully met training objectives and fleet requirements. Today (Sep 17), with 21 new courses added, 88 of 155 courses of instruction or 58% now fully meet the mandated requirements. By 2020, the number will increase to 160 of 191 engineering courses or 84%. In 2010, only one engineering course employed simulation to help deliver skill sets. Today, ALL engineering courses employ multiple virtual software applications / simulators. 88 HM&E systems have been modeled to date and employed predominantly in engineering maintenance training. Eight (8) new maintenance NECs have been added, 53 have been substantially revised and updated, and 14 new NECs are in development / routing. In 2011, only 3,341 apprentice and journeyman level engineering billets out of 7,706 or 43% had any formal training associated with the billet. By 2020, it is projected that there will be 6,081 apprentice and journeyman billets out of an expanded base of 9,468 billets or 64% with formal training, equating to having an additional 2,740 engineers with formal training, a 82% increase from 2011</p>

Recommendations	Steps/Actions taken (e.g. policies implemented, signed instructions, etc.)	Results and/or impacts of steps/actions taken (where applicable)
3.5.2(a)-Conduct a comprehensive review of occupational standards for surface technical ratings to support improvement of apprentice level training	At the direction of NETC, SWOS conducted a comprehensive review of Surface Engineering Training Wholeness in 2011 assessing the effectiveness / robustness of the schoolhouse training for some 714 individual shipboard engineering billets in the Fleet followed by a comprehensive curriculum health assessment in 2012 focusing on some 134 engineering courses of instruction. The results of both efforts informed the design and implementation of a comprehensive Surface Enlisted Engineering Training Restoration (and Modernization) Plan in 2012. This plan informed some \$280M in investments through the Surface and Expeditionary Warfare Training Committee (SEWTC) since POM-13	The analysis supported the design and implementation of a comprehensive plan and investment strategy to restore and modernize Enlisted Engineering training. To date, \$280M have been invested by the SEWTC towards this effort
3.5.2(b)-Relocate more C schools to fleet concentration areas to provide additional opportunities for advanced skills development. This approach may require traditional lengthy C schools to be modularized for accomplishment in yearly increments and for delivery in fleet concentration areas	Of the 21 new courses of instruction fielded since 2013, the vast majority of which were NEC producing C-Schools, 14 or 66% were established at the Fleet Concentration Areas. Of the 24 revised courses of instruction updated since 2013, again the majority of which were Fleet schools or NEC producing C-Schools, 20 or 83% were established at the FCA	More training is slated to be fielded to the FCAs over the next few years as part of the comprehensive Surface Enlisted Engineering Training Restoration Plan
3.5.2(c)-Develop formal afloat technical training program. See also section 5.3	Self-Assessment Groom Training (SAGT) put in place to develop technical training. Additionally, CNSF developed the Continuous Training Instruction to ensure that ships have guidance for the development and implementation of a technical training program	CNSF has put the SFRM in place which incorporates the SFEM, TSRA, and RE manuals to improve technical training onboard the ship. Additionally, during the RE-3 process, PQS tailoring is specifically reviewed to ensure ship technical training is in place

Recommendations	Steps/Actions taken (e.g. policies implemented, signed instructions, etc.)	Results and/or impacts of steps/actions taken (where applicable)
3.5.2(d)-Incorporate into all surface warfare officer training curricula a foundation and understanding of the material readiness standards of the surface force as developed in response to section 3.8	All SWO training curricula as well as all Enlisted Engineering training curricula provides a foundation and understanding of the material readiness standards of the surface force. Proper watch standing and procedural compliance are emphasized in all SWOS courses of instruction from Accession training through O-6 Major Command	BDOC, ADOC, and 3MU have been established with readiness standards incorporated into the COIs. Additionally, all other SWO courses have incorporated material readiness into the COIs. Additionally, Standard Ship Operating Procedures (SSOP) are tested in every COI
3.5.2 (e)-Concur with the restart of the SOSMRC course of instruction for prospective executive officer and prospective commanding officers. See also section 5.4.1	SOSMRC has been restarted. Command Qualification Process modified, now includes engineering examination at SWOS as pre-requisite for command at sea	No assessment criteria or process has been established
3.5.2(f)-Move RMCs to the waterfront to improve intermediate level maintenance responsiveness and increase potential Sailor technical training opportunities	<p>The physical location of the RMCs has not changed; however, the Navy Afloat Maintenance Training Strategy (NAMTS) program management responsibilities were transferred to CNRMC on 1 OCT 2010 per CNRMCINST 4700.10, NAVY AFLOT MAINTENANCE TRAINING STRATEGY (NAMTS) PROGRAM in response to findings and recommendations.</p> <p>- The NAMTS Program was established to improve battle group organic maintenance capability and material self- sufficiency. Sailor knowledge and proficiency in performing shipboard repairs are essential to these efforts. The NAMTS Program provides formal shipboard systems and equipment repair training for Sailors assigned to intermediate and depot level maintenance activities and selected afloat commands</p>	CNRMC has been monitoring MILPERS assignments/annual funding levels. CNRMC will update the FCRC in October on the proposed MILPERS cuts

Recommendations	Steps/Actions taken (e.g. policies implemented, signed instructions, etc.)	Results and/or impacts of steps/actions taken (where applicable)
3.6.2(a)-Interrupt the current downsizing of RMC Sailors now until the optimum mix of sea-shore rotation and ship repair needs can be determined. RMC manning estimates in section 3.4 of this report consider maintenance needs only and not those of sea-shore rotation	USFF advocated to halt downsizing of the RMC's and requested additional investments in manpower	RMC downsizing was halted and starting in 2010, investments meant to improve sea-shore rotation were instituted. Since 2010, 1,188 additional billets have been funded.
3.6.2(b)-Establish core capabilities for each RMC similar to those in San Diego. These do not have to be identical and in fact, some differences will provide Sailors even more technical opportunities and experience on shore duty	RMC Core Capabilities are provided in Appendix A of COMUSFLTFORCOMINST 4790.3 REV C CH-2, VOL VI CH 35, REGIONAL MAINTENANCE CENTER I-LEVEL MAINTENANCE CAPABILITIES. Appendix A is the Capability Matrix and establishes the capabilities of each RMC (MARMC, SERMC, SWRMC, MWRMC, HRMC)	N/A
3.6.2 (c)-Shift control of RMCs to the surface Type Commanders	CNRMC was established 15 DEC 2010 as a NAVSEA managed activity	NAVSEA retains control of RMCs

Recommendations	Steps/Actions taken (e.g. policies implemented, signed instructions, etc.)	Results and/or impacts of steps/actions taken (where applicable)
<p>3.6.2(d)-Establish common focus among RMCs to reinforce material readiness goals and training of Sailors, creating a culture of proactive maintenance and development of force-wide technical expertise</p>	<p>The establishment of a common focus among RMCs was provided in COMSUFLTFORCOMINST 4790.3 C CH-2, VOL VI CH 35. This chapter outlined the responsibilities of the Fleet Commanders, RMC Commanders, RMCs, and provided RMC Performance Measures.</p> <p>-Additionally, the Navy Afloat Maintenance Training Strategy (NAMTS) program management responsibilities were transferred to CNRMC on 1 OCT 2010 to create a common focus among RMCs and strengthen their ability to provide intermediate level maintenance support and selective maintenance training to surface ships, submarines, shore activities and other commands, per CNRMCINST 4700.10, NAVY AFLOT MAINTENANCE TRAINING STRATEGY (NAMTS) PROGRAM in response to findings and recommendations.</p> <p>-The NAMTS Program was established to improve battle group organic maintenance capability and material self-sufficiency. Sailor knowledge and proficiency in performing shipboard repairs are essential to these efforts. The NAMTS Program provides formal shipboard systems and equipment repair training for Sailors assigned to intermediate and depot level maintenance activities and selected afloat commands</p>	<p>CNRMC has been monitoring MILPERS assignments/annual funding levels. CNRMC will update the FCRC in October on the proposed MILPERS cuts</p>

Recommendations	Steps/Actions taken (e.g. policies implemented, signed instructions, etc.)	Results and/or impacts of steps/actions taken (where applicable)
3.6.2 (e)-Expand SSLCMA to a SURFMEPP organization mirroring SUBMEPP in responsibilities, resources, and authority. The accelerated plan proffered by SEA 21 in Appendix 012 is considered a great start but not considered comprehensive enough or fast enough	SSLCMA was expanded to a SURFMEPP organization mirroring SUBMEPP per NAVSEAINST 5450.142B MISSION, FUNCTIONS AND TASKS OF THE SURFACE MAINTENANCE ENGINEERING PLANNING PROGRAM ACTIVITY, PORTSMOUTH, VIRGINIA dtd 17 AUG 2016	SURFMEPP provides centralized surface ship life cycle maintenance engineering, class maintenance and modernization planning and management of maintenance strategies aligned with and responsive to national, fleet, Surface Type Commander and Naval Sea Systems Command (NAVSEA) requirements and priorities
3.6.2(f)-Create from current waterfront manning resources a readiness ISIC	Material condition assessments are staffed through the CSG/ESG/TYCOM who has the responsibility of the R-ISIC and has the full authority to complete assessments in the form of Material Inspections performed through the FRP to assess ship's material and training readiness to ensure the ship is ready to meet mission requirements. Readiness Evaluations (READ-Es) are designed to assess a ship's readiness across the full spectrum of manning, material, and training, and to provide periodic feedback to the appropriate Immediate Superior in Command (ISIC) and Type Commander (TYCOM) per COMNAVSURFPAC/COMNAVSURFLANT INSTURCTION 3502.3, SURFACE FORCE READINESS MANUAL	N/A
3.7.2 (a)-Retain the SWE as a collaborative body but only so long as it does not encroach upon the chain of command	SWE utilizes RKC methodology to document and assess the health of current and readiness issues of each ship class annually. Inputs provided across the PESTONI readiness domain, including waterfront inputs	SWE develops: Future Warfighting Priorities to influence POM deliberations; Current Readiness Top Concerns, to focus PESTONI pillars' resource prioritization; and examines maintenance and modernization alignment with OFRP via Surface Master Plan, providing inputs to MOPP

Recommendations	Steps/Actions taken (e.g. policies implemented, signed instructions, etc.)	Results and/or impacts of steps/actions taken (where applicable)
<p>3.7.2 (b)-Promulgate a clear message on standards promoting the importance of ownership and self-sufficiency. Near term: Rebalance ships' daily work routine to permit attaching the TA4 backlog (appendix 007) and improve damage control closure readiness to "Satisfactory" (appendix 010). The recognized initiatives to improve readiness will require more effort and more time on the part of our crews</p>	<p>Back to Basics message, CNSF Warfighting serials, and Sound Shipboard Operating Principles (SSOP) have been promulgated to ensure standards are understood. Additionally, the RE-4, 5, 6, and 7 also assess self-assessment</p>	<p>Self-assessment scores have been increasing</p>

Recommendations	Steps/Actions taken (e.g. policies implemented, signed instructions, etc.)	Results and/or impacts of steps/actions taken (where applicable)
<p>3.8.2(a)The incongruence between the oft-stated need for resources and requirements at the shipboard level and the physical observations of ships' current workday suggests consideration should be given to daily work routine changes for accomplishing more ships maintenance</p>	<p>While no formal guidance has been promulgated providing guidance on daily work routines, work studies/assessments have been conducted to determine proper manning levels on ships and impacts to crew work hours, in particular, the impacts to crews when RRL is implemented and personnel are TDY attending training courses. Note that work routines are set by the individual unit based on requirements and priorities. Some actions have been taken to better focus ship activities:</p> <ol style="list-style-type: none"> 1. Reduction of administrative burden MESSAGE/initiative 2. Reinstating the SOSMRC course 3. Total Ship's Readiness Assessment (TSRA) process 4. In 2012 the Surface TYCOM revamped the 3-M certification process TYCOMINST 4790.1G 5. From a resource perspective, manning numbers continue to drop across the Force. High accession numbers in FY13 gave a temporary spike in Fleet manning, raising them to historical levels, but as those Sailors complete their sea tours and rotate to shore, manning will continue to decrease. There were 1,546 billet gaps at sea in MAR 2016, and that number increased to 6,592 gaps by MAR 2017. The numbers will continue to drop into 2018 and not start to improve again until sometime in 2019 	<p>Results of steps taken:</p> <ol style="list-style-type: none"> 1. More time for daily work routine 2. Leadership realigned on maintenance focus 3. Brought RMC experts to the ship to assist in materiel assessments 4. Added even more weight to the self-assessment and CSMP management scoring process <p>- Although Enlisted Community Managers advertise being manned to 100% or higher across the majority of Navy ratings, a historical friction (LIMDU, Screening failures, Legal issues, etc) that averages around 15% causes sea duty to have a relatively high number of gapped billets in certain ratings</p>

Recommendations	Steps/Actions taken (e.g. policies implemented, signed instructions, etc.)	Results and/or impacts of steps/actions taken (where applicable)
3.8.2(b)-Insert on the waterfront, a command and staff (nominally a readiness ISIC), responsible for communicating, inspecting, and maintaining material standards on the assigned ships. This staff should be accountable, responsible, and have the authority to fully complete these tasks	Material condition assessments are staffed through the CSG/ESG/TYCOM and have the full authority to complete assessments in the form of Material Inspections performed through the FRP to assess ship's material and training readiness to ensure the ship is ready to meet mission requirements per COMNAVSURFPAC/COMNAVSURFLANT INSTURCTION 3502.3, SURFACE FORCE READINESS MANUAL	Surface Force Readiness Manual Events: -Engineering Readiness Assist Team (ERAT) - Subject Matter Experts conduct on-site assistance/training on identifying and correcting material/operational discrepancies -INSURV Readiness Assist Team (IRAT) - INSURV Preparations -READ-E 2 - TYCOM-led assessment of material condition executed during the Sustainment Phase completed before the Maintenance Phase. Demonstrations are conducted during this period to identify any material condition degradations that occurred during the course of deployment and ensure that the ship maintains a constant focus on material assessments and standards
3.8.2(c)-Adjust the curricula of all A schools, C schools, and officer schools to include a clear and unequivocal message on standards, ownership, and self-sufficiency	Back to Basics message, CNSF Warfighting serials, and Sound Shipboard Operating Principles (SSOP) have been promulgated to ensure standards are understood. All SWO training curricula as well as all Enlisted Engineering training curricula includes a clear and unequivocal message on standards, ownership, and self-sufficiency. Proper watch standing and procedural compliance are emphasized in all SWOS courses of instruction from Accession training through O-6 Major Command	All curricula enforce and re-enforce standard of ownership. SSOPs are tested in all COIs
3.8.2(d)-Use the proposed 2 FRTP cycle assessment proposal recommended in Section 3.3 to reinforce the new standards at all levels of ships assessed	OFRP established in 2014 and surface force following OFRP FRTP guidelines based on Master OFRP Production Plan	Recommendation superseded by OFRP

Recommendations	Steps/Actions taken (e.g. policies implemented, signed instructions, etc.)	Results and/or impacts of steps/actions taken (where applicable)
3.8.2(e)-Expand the current CNSF readiness initiative to quantify and qualify the new message on standards where compliance is critical to safety, life and operations. Consider completion redlines and formal certification for CMAVs (TYCOM), CNO availabilities (SURFMEPP) and readiness for sea (TYCOM)	SFTM replaced with SFRM, SFEM, TSRA Manual and Readiness Evaluation Manual. SFRM defined exit criterion across all PESTO pillars in each phase of OFRP (MP, BP, IP, SP) to ensure readiness for transition to next phase. SSOP, focused on 6 standard operating procedures and PBED process, developed, promulgated to all schoolhouse for curriculum use, and issued to all CNSF Sailors for implementation and training. SSOP taught and tested in SWOS and CSCS COIs	SFRM defined rigor in training, material readiness, and assessment processes well beyond SFTM. SFEM, established a repeatable and predictable training process to ensure all ship's establish baseline level of knowledge and proficiency (Note: SFRM published in 2012 prior to OFRP implementation/execution)
3.8.2(f)-Include in assessments, inspections, audits, and certifications by third party teams a formal review of ship compliance with established new standards. The R-ISIC should be the Chief Assessor for each activity and oversee this review	The CSG/ESG/TYCOM has the responsibilities of the R-ISIC. To ensure readiness for scheduled deployments, external assessments and inspections through the TYCOM will validate proficiency and satisfactory material condition as the ship progresses through the FRTP per COMNAVSURFPAC/COMNAVSURFLANT INSTRUCTION 3502.3, SURFACE FORCE READINESS MANUAL	N/A

Recommendations	Steps/Actions taken (e.g. policies implemented, signed instructions, etc.)	Results and/or impacts of steps/actions taken (where applicable)
<p>3.8.2(g)-Initiate a review to determine means of reducing TYCOM fluctuating execution year maintenance funding for surface ships. The inquiry should include the related costs associated with late planning or late cancellation of maintenance</p>	<p>The following steps have been implemented:</p> <ol style="list-style-type: none"> 1. Revised CMAV Milestone in JFMM (interim guidance published Oct 2017) 2. Improve Understanding of Ship's Material Condition and CSMP Quality (COMNAVSURFOR CSMP BEST PRACTICES MESSAGE R 192145Z JUL) 3. Front Load Reservation Task Requests (RTR) on known HM&E work items that are prone to growth as a standard practice for planning/funding CNO avails 4. Transition to Firm-Fixed Price Contracting 5. CNSL/P expanded Maintenance University to enhanced deck plate training and CNO Availability Planning and Execution Briefs for every ship 	<p>Continuous Maintenance Availabilities are allowing work to be planned and screened to support availabilities in a timely fashion. CMAV milestones revision will be signed and published in Oct 2017.</p> <ul style="list-style-type: none"> - Improved CSMP quality will allow more accurate work specifications which in turn reduces the need for costly rework and improves the availability planning process - Reduces RCC cycle time by front loading work that can be initiated without time consuming process of contract changes - Has reduced the amount awarded for CNO availabilities but has also shifted much of the schedule, performance responsibility from the Gov't to the Contractors - Maintenance University focuses on maintenance management and incorporates many of the issues addressed in the report at all levels of SWOS from DIVO to Major Command
<p>3.9.2(a,b)-Fund corrosion control audits and ABS surveys to the fullest extent possible in order to accelerate identification of the deep maintenance requirement</p>	<p>Per COMUSFLTFORCOMINST 4790.3 REV C, CH-5, 3.5.1.2.1, dated 11 AUG 2016, The Corrosion Planning Conference: SUFMEPP, TYCOM representatives, RMC, CNRMC, Ship Repair Facility (Japan only) and Ship's Project Team, reviews current FRP cycle corrosion requirements. Per NAVSEAINST 5450.142B corrosion control is part of SURFMEPP mission functions and tasks</p>	<p>Example: In FY11 only approximately 60% of the tanks in the Fleet had reliable data in the Corrosion Control Information Management System. Through aggressive and disciplined execution of surveys and repairs the Fleet has increased the know conditions of tanks to 98%. Corrosion control process status is an element of the quarterly SURFMEPP briefs to FFC N43</p>

Recommendations	Steps/Actions taken (e.g. policies implemented, signed instructions, etc.)	Results and/or impacts of steps/actions taken (where applicable)
3.9.2(c)-Increase CMAV planning window to decrease premium time costs and improve maintenance accomplishment	Planning requirements are established in JFMM REV C CH-5 VOL II CH 2 dated 11 AUG 2016	No assessment criteria has been established
3.9.2(d)-Define and fully fund continuous maintenance and depot maintenance requirements	<p>Depot Maintenance requirements are defined using Technical Foundations Papers as a baseline. Ship Sheets are used to updated requirements for deferred or unanticipated work per NAVSEAINST A36 and OPNAV LTR 4700 SER N83/137005. However, OPNAV N83 continues to validate the requirement at some level less than 100% based on several factors such as ship class and remaining service life. Note: Balisle Report surmised that the Navy had been underfunding and understated requirement for many years:</p> <p>We began fully recognizing ship maintenance requirements:</p> <ul style="list-style-type: none"> - 2010 - \$200M in buy down of 2011 requirement - 2011 ~\$400M in buy down of 2012 requirement ~\$500M increase in ship maintenance funding from FY10 to FY12 - Increased Programmed requirements - Increased execution year growth <p>Note: DON-19 ship depot maintenance funding between 97% to 100% of requirement across the FYDP</p>	SURFMEPP's Class Maintenance Plans are adjusted as more data on the effects of partial funding is gained. The hidden costs are in growth in avail costs and longer term ESL affects. These hidden costs are coming to light as SURFMEPP's processes mature. We also have to note that the unpredictability of funding, given we have been operating under CRs, is also a contributing factor in properly funding maintenance execution

9.8 Government Accountability Office and the Center for Naval Analyses Reports and Summary of Actions

In support of this comprehensive review, the Navy provided an update on actions taken as a result of other reviews performed over the past eight years related to Navy readiness. The matrices in this enclosure supply the update for actions related to various reports issued by the Government Accountability Office and Center for Naval Analyses (CNA). The Review Team concludes the actions described herein have not been fully effective in creating a lasting change. While many factors affect the ability to sustain improvements, including budgetary constraints and world events affecting the demand for Naval forces, this Review Team did not attempt to perform a more detailed review of the specific actions related to previous reports. Some findings and recommendations for improvement detailed in this report align with previous reviews.

Report/Study	Overview	Recommendations	Actions taken
<p>Report 1: Improved strategic planning needed to ensure that Navy depots can meet future maintenance requirements (GAO report-June 2010)</p>	<p>Report provides an assessment of the Navy's 2007 Depot Maintenance Strategic Plan. GAO assessed the strategic plan by looking at:</p> <p>(1) elements of a results-oriented management framework</p> <p>(2) OSD's direction for the plan's content</p>	<p>Recommend SECDEF direct SECNAV to take the following actions:</p> <ol style="list-style-type: none"> 1. Fully and explicitly address all elements needed for a comprehensive results-oriented management framework, including those elements that we have identified as partially addressed or not addressing the current plan 2. Demonstrate clear linkages among plans should the Navy continue to submit individual depot maintenance strategic plans instead of a single Navy-wide plan 3. Fully and explicitly address the four critical areas of logistics transformation, core logistics capability assurance, workforce revitalization, and capital investment, consistent with OUSD (AT&L) criteria 4. Develop and implement procedures to review revisions of the depot maintenance strategic plan to ensure they fully address all key elements of a results-oriented management framework, explicitly address an OUSD (AT&L) direction for the plans, and periodically assess progress and corrective 	<p>Assistant Secretary of Defense noted: Navy will be directed to be more results-oriented in their next depot maintenance strategic plan and be required to more clearly demonstrate the linkages of their depot maintenance strategy to DOD's depot maintenance strategic plan</p> <p>GAO's four recommendations:</p> <ol style="list-style-type: none"> 1. Fully and explicitly address all elements needed for a comprehensive results-oriented management framework, including those elements that we have identified as partially addressed or not addressed in the current plan: <ul style="list-style-type: none"> * Current status: GAO -10-585 caused the Navy to write the comprehensive Depot Strategic Plan that was issued in October 2013. While this Plan reflects several of the elements of a comprehensive results-oriented management framework, there is no specific mention of the intent to use that methodology in preparation of the Report 2. Demonstrate clear linkages among plans should the Navy continue to submit individual depot maintenance strategic plans instead of a single Navy-wide plan: <ul style="list-style-type: none"> * From Page 9 of the United States Navy Depot Maintenance Strategic Plan (Oct 2013): OPNAV N4 and N9, NAVSEA , NAVAIR), COMFRC, SPAWAR, NAVFAC, NAVSUP, and the warfare enterprises (i.e., USE, NAE, SWE, and NECE) are listed as stakeholders in the Plan 3. Fully and explicitly address the four critical areas of logistics transformation, core logistics capability assurance, workforce revitalization, and capital investment, consistent with OUSD (AT&L) criteria. <p>DoD's Response in the Report: The department concurred with GAO's recommendation to direct SECNAV to revise the Navy's depot maintenance strategic plan to fully and explicitly address all</p>

Report/Study	Overview	Recommendations	Actions taken
		actions to the extent needed in meeting the plans' goals	<p>elements needed for a comprehensive results-oriented management framework:</p> <ul style="list-style-type: none"> * From Page 11 specifically and throughout the United States Navy Depot Maintenance Strategic Plan (Oct 2013): The Navy Depot Maintenance Strategic Plan is structured on the DoD depot maintenance strategic elements: <ul style="list-style-type: none"> - Logistics transformation - Core logistics capability assurance - Workforce revitalization - Capital investment <p>4., Develop and implement procedures to review revisions of the depot maintenance strategic plan to ensure they fully address all key elements of a results-oriented management framework, explicitly address any OUSD (AT&L) direction for the plans, and periodically assess progress and corrective actions to the extent needed in meeting the plans' goals:</p> <ul style="list-style-type: none"> * Current status: There have been no efforts made to revise the October 2013 Strategic Plan since it was issued, and hence no need to develop and implement procedures to address the elements of a results-oriented management framework
Report 2: Analyzing the Individual Level Training Continuum within the Surface Force: A Framework (CNA report-April 2011)	Policy decisions made outside of Navy training enterprise severely impact the ability of Navy to properly train to perform expected missions. To address this issue CNA developed a theoretical framework for the	Refine and focus data collection analysis to provide information on training progression against desired proficiency, effectiveness and system utilization: <ol style="list-style-type: none"> 1. Formalize and standardize OJT and grading criteria 2. Improve tie between qualification and training 3. Train the trainers of OJT 4. Increase waterfront training presence to enable more 	<p>PMS 339 (Surface Training Systems) conducts data collection (from current sources) and analysis to support the effectiveness of Navy schoolhouses and Self-Assessment Groom and Training (SAGT).</p> <ol style="list-style-type: none"> 1. CNSF developed the Continuous Training Instruction (CNSP/L 1500.1) to ensure that ships have guidance for the development and implementation of a technical training program. Lesson Topic Guides on ship and in each division. Shipboard trainers tailor training to the specific audience, to include the proficiency in the topic 2. READ-E (Readiness Evaluation) 3 reviews PQS program. New Continuous Training Instruction requires LOK Quizzes based on Divisional Training, but those

Report/Study	Overview	Recommendations	Actions taken
	training continuum to analyze and mitigate the possible impacts of policy decisions impacting Navy training	hands on training and align training equipment to the systems in use	<p>do not follow the Sailor to assess an individual Sailor's career-spanning level of knowledge</p> <p>3. As part of Basic Phase, ATG trains the trainers and the Sailors. SBTT, recently reinstated, resurrected emphasis on training the training teams.</p> <p>4. ATG, CSCS, NSMWDC, CSG-4, and TYCOM onboard throughout OFRP to train ships. SAGTs provide Sailors with direct training on their shipboard systems. Gives the Sailors skills to train:</p> <ul style="list-style-type: none"> - ATG manning increased significantly after Balisle Report - Enable more hands on training with systems in use - Establishment of NSMWDC specifically funded training and trainers to improve ships for integrated training - Increased number of billets at Intermediate-Level Maintenance facilities has led to Sailors being better educated in the systems to then train as part of ship's company
Report 3: Navy Needs to Assess Risks to Its Strategy to Improve Ship Readiness (GAO report-September 2012)	Assessed: 1. How Navy evaluates material readiness of its surface combatant and amphibious warfare ships and the extent to which data indicate trends or patterns in material readiness of these ships 2. Extent to which Navy has taken steps to improve readiness of its	Recommend SECDEF direct SECNAV to take the following actions: 1. Develop a comprehensive assessment of the risks Navy faces in implementing its Surface Force Readiness Manual strategy, and alternatives to mitigate risks. Specifically, a comprehensive risk assessment should include an assessment of risks such as high operational tempos and availability of personnel 2. Use the results of this	<p>Under Secretary of Defense responded that:</p> <p>1. Comprehensive risk assessment associated with implementation of Navy's Surface Force Readiness strategy is neither necessary nor desirable</p> <p>2. Navy's existing assessment processes are sufficient to enable necessary adjustments to their Surface Force Readiness strategy</p> <p>* Concur with USD Assessment. Since the inception of the Surface Force Readiness Strategy the Navy has adapted and expanded its assessment processes. The following actions have been taken since 2011-2012 with the publication of the Surface Force Readiness Manual (SFRM):</p> <ul style="list-style-type: none"> - TSRA (Total Ship Readiness Assessment) Alignment. Instituted to execute shipboard

Report/Study	Overview	Recommendations	Actions taken
	surface combatant and amphibious warfare ships, including implementing its new readiness strategy	assessment to make any necessary adjustments to its implementation plan	assessments to improve current readiness and assist with maintenance availability planning via an over-the-shoulder approach to training ships force maintenance personnel - Readiness Evaluations (READ-E). Designed to assess a ship's readiness across manning, materiel, and training, and to provide periodic feedback to ISICs and TYCOM. READ-Es (1-7) provide assessments at different phases of the ships OFRP
Report 4: Navy Training Whitespace Limitations (CNA report- June 2013)	CNA undertook a small-scoped effort to understand if and why Naval personnel are facing whitespace limitations. The study established whitespace constraints for both officer and enlisted personnel, identifying “day job” responsibilities, manpower policies and equipment deficiencies as possible causal factors	Thorough study of regularly recurring job and operational requirements during inter-deployment period with particular emphasis on whether the time burden of these requirements is tied to ship variables like ship age or condition, fit/fill of personnel or inter-deployment length	* This is a NAVMAC function and has already been implemented. The SNWW was adjusted about 2 years ago and they have begun conducting in-port workload studies by Class. DDG 51 Class was the first and that study has not been released as of yet
Report 5: Sustainable Plan and Comprehensive Assessment Needed to Mitigate Long-Term Risks to Ships Assigned to Overseas	Addresses: (1) the operational benefits, costs, and readiness effects associated with assigning ships to U.S. or overseas homeports and;	Recommend SECNAV take the following actions: 1. To fully implement its optimized fleet response plan, develop and implement a sustainable operational schedule for all ships based overseas	ASN-RDA memo dated 18 May 2015: 1. Navy implementing OFRP for all FDNF forces (schedule piece) 2. Navy will conduct assessment of long-term costs and risks of overseas homeporting and incorporate into future homeporting decisions * OFRP implemented as the operational framework delivering rotational and FDNF units and strike groups

Report/Study	Overview	Recommendations	Actions taken
Homeports (GAO report-May 2015)	(2) the extent to which the Navy has identified and mitigated risks from homeporting ships overseas	2. Develop a comprehensive assessment of the long-term costs and risks to the Navy's surface and amphibious fleet associated with its increasing reliance on overseas homeporting to meet presence requirements, make any necessary adjustments to its overseas presence based on this assessment, and reassess these risks when making future overseas homeporting decisions and developing future strategic laydown plans	<p>to fulfill GFMAP commitments, while continuing to provide surge capability. OFRP improves the fleet's readiness generation process by providing a balanced, sustainable, and predictable force generation cycle – maximizing force employability. The resulting readiness generation cycle operationally and administratively aligns forces while stabilizing manning, optimizing maintenance/modernization, consolidating and streamlining inspections and evaluations, training to a single high-end standard, and improving and enhancing Quality of Service for our Sailors. Also in 2014, C7F, C6F, & C5F in coordination with the applicable TYCOMs, (CNSP and CNSL) developed and implemented a sustainable OFRP model (e.g., operational schedule) for all ships based overseas. FDNF OFRP cycle lengths vary across the Navy and provide a balance between maintenance and modernization, training requirements, and operational availability.</p> <ul style="list-style-type: none"> - FDNF Japan based ships execute a 24 month cycle - FDNF Europe ships execute a 32-month cycle - FDNF Bahrain PCs execute a 36 month cycle and MCMs execute a 24 months cycle <p>* Although FDNF units are continuously deployed and therefore operate in a perpetual sustainment phase, required inspections, certifications, assist visits, and personnel, equipment, supply, training, and ordnance readiness requirements are conducted on a repetitive schedule throughout their cycle (e.g., a sustainable operational schedule) to ensure proficiency and readiness for forward deployed operations does not atrophy. The Navy's established and enduring Strategic Laydown and Dispersal (SLD) process provides strategic rationale, guidance, and direction to approve and implement individual homeport, home</p>

Report/Study	Overview	Recommendations	Actions taken
			<p>base, and hub shifts, to include forward deployed forces</p> <p>* SECNAV, based on recommendations from the CNO, disperses CONUS and FDNF units of the Navy's operating forces to worldwide locations in a deliberate manner that directly supports DoD guidance and policy. The annual SLD plan is CNO's expression of DoD guidance and policy, as well as Navy-specific guidance. This plan forecasts 10 years for the purpose of PPBE unit moves, and presents for approval the projected homeports, home bases, and hubs of the Navy's operating forces and staffs for a 5-year period. The SLD process consists of two major phases: a design phase followed by an assessment phase. The design and assessment phases are aligned to support and inform the Navy's POM submission, provide CNO a comprehensive plan for approval, and precede the Congressional testimony of senior Navy leadership</p> <p>* OPNAV N46 is responsible for assessing the annual SLD plan. OPNAV N46 leads a cross-functional working group that determines SLD plan execution; recommends program changes, adjustments to its overseas presence, or mitigations; assesses responsibilities to organize, man, train, maintain, equip, and sustain naval forces to meet combatant commander and NCC warfighting capability and operational readiness requirements. OPNAV N4 will subsequently recommend to the CNO mitigations for any impacts caused by operational, support, and readiness factors to include submission of planning and programming input to the PPBE process. Upon the conclusion of the assessment phase, OPNAV N4 coordinates with OPNAV N3/N5 to produce a comprehensive SLD plan for briefing to CNO and SECNAV, highlighting key findings and actions for decision and approval</p>

Report/Study	Overview	Recommendations	Actions taken
<p>Report 6: Progress and Challenges in Implementing the Navy's Optimized Fleet Response Plan (GAO report-May 2016)</p>	<p>Review matters related to the Navy Optimized Fleet Response Plan. Report describes: (1) the extent of maintenance overruns and their impact on the Navy; (2) the Navy's goals and progress in implementing the OFRP; and (3) challenges faced by public and private shipyards supporting the implementation of OFRP</p>	<p>No recommendations made-for information only (challenges identified)</p>	<p>* Fleet understands that maintenance delays impact the entire OFRP cycle and reduce overall force employability. More specifically, maintenance delays/overruns impact the unit's ability to effectively complete its FRTP and deploy with sufficient "reps and sets" to meet high-end standards. Providing sufficient and predictable ship maintenance funding, increasing the number of shipyard workers, improving shipyard infrastructure and training programs, and improvements in maintenance planning will improve shipyard performance overtime and reduce the number of maintenance overruns</p> <p>* USFFC and OPNAV N4 advocacy for aviation spares funding (APN-6) has resulted in improved funding posture through the FYDP (FY19-23). APN-6 is funded at 89% (BAM-19 BLIII) through the FYDP, which is above the 85% minimum threshold required to prevent backlog growth. Current APN-6 backlog is [NM: \$32M / NA: \$421M] down from [NM: \$82M / NA: \$586M] one year prior. USFFC continues to advocate for maritime spares outfitting funding (OPN-8); funding trends indicate OPN-8 will remain well below the minimum 85% threshold; sitting at 69% through the FYDP (FY19-23). Current OPN-8 backlog sits at [NM: \$33M / NA: \$33M] which constitutes a significant increase from one year prior [NM: \$8M / NA: \$28M]. Absent additional OPN-8 funding, USFFC urges the prioritization of the 'outfitting' accounts over 'interim' within the OPN-8 program; 'outfitting' maintains high execution rates and fills storeroom 'holes; on in-services ships. USFFC, in conjunction with OPNAV N4 and NAVSUP also recommend funding the change to the price-sensitive FLSIP COSAL model to improve maritime spares posture and resiliency at reasonable cost</p> <p>* Delayed Maintenance Days are reported quarterly in</p>

Report/Study	Overview	Recommendations	Actions taken
			<p>the IFRR. This metric is showing a performance improvement (decreasing trend) in FY17 when compared with FYs 14 - 16. The three CVN availabilities completed at the Naval Shipyards in 2017 were on time or early. This measurement is part of a larger process of measuring CSG OFRP schedule compliance as each CSG completes an OFRP cycle. Specific to Growth and New Work (G/NW) in the shipyards, ensuring Surface Ships reach their Expected Service Life is being addressed under processes implemented at SURFMEPP over the last several years. As these processes mature, we expect that Growth and/or New Work percentages to decline. However, uncertain budgeting processes (Sequestration and Continuing Resolutions in particular) lead to deferred maintenance actions that become G/NW in subsequent availabilities. Navy and private shipyard officials agree that the personnel security protocols, procedures, and policy issues affecting contractor personnel performing ship maintenance has improved and are no longer a major concern</p> <p>* Hiring challenges: Currently civilian hiring is taking a hit for backlogs and getting quality candidates to fill jobs. OPM/DOD/SECNAV have provided many flexibilities for hiring with Direct Hire Authority however due to current OCHR manpower shortages, it is difficult at best to get the jobs filled. On average it is taking four months to get an assessment initiated to begin preparation for announcing vacancies. This is systemic OCHR wide and in some ways a result of the MHA requirements for which OCHR had to take a major hit. Until HR is able to move forward with hiring, this challenge will continue. Recommend SECNAV provide authorization and funding for additional hires within the HR community</p>

Report/Study	Overview	Recommendations	Actions taken
Report 7: Surface TYCOM Organizational Analysis (CNA report- July 2016)	Study provides insight into the current command structure, and provides options to improve the ability of CNSF, CNSP and CNSL to meet assigned missions and responsibilities to effectively man, train, and equip the surface force. CNA focuses on three issues: 1) re-examination of the status of the lead/follow concept 2) effectiveness of executive agents acting on their TYCOMs behalf at locations outside Fleet concentration areas 3) a case study of forces based in Bahrain	1. CNSF should take steps to increase the overlap of the SWE with the TYCOMs by setting the agenda for the SWE 2. Identify specific objectives for desired capabilities or processes to allow further analysis of reorganization options to mitigate disruptive effects in manning, training and equipping to meet these options 3. Define the changes to TYCOM man, train and equip processes brought by OFRP implementation. Consider the roles of EA and supporting commands	* CNSF sets the agenda/focus of the SWE based on Fleet Commander priorities. Studies are ongoing (BSO 60/70, CNIC/NAVFAC, etc.) to examine how changing organizational alignments could improve both mission effectiveness and our overall efficiency of operations. Regarding TYCOM OFRP implementation, a significant change was establishing increased manning requirements (92% Fit and 95% Fill) for our units as they enter basic phase training. This has increased the stress on our ability to man our platforms given distributable inventory shortfalls. Another aspect, which was also present under FRP, is ensuring maintenance/modernization performance is improved so units can execute their planned FRTPs and not be faced with compressed pre-deployment training
Report 8: Optimized Fleet Response Plan Implementation Issues (CNA report– Feb 2017)	Study provides and assessment of the achievability and longevity of OFRP implementation with focus on three major areas: 1) Maintenance and	1. Pursue a common dashboard for the OFRP scheduling process, building on the Surface Master Plan and the Master Aviation Plan 2. Study the robustness of OFRP in meeting emergent demands for additional forces	* Fleet Training Continuum and OFRP instructions are under review / revision. Both of these Fleet-wide policy documents delineate Fleet training (e.g., high-end) and establish notional training durations. The Fleet-wide revision for both of these instructions incorporates changes that will ensure Navy forces have adequate time and resources to execute high-end training. For example, USFF / CPF expanded notional training

Report/Study	Overview	Recommendations	Actions taken
	<p>scheduling</p> <p>2) Manning</p> <p>3) Training</p>	<p>3. Train an additional 6600 personnel in NECs needed to meet OFRP NEC targets</p> <p>4. Increase VAW and VFA manning by approximately 150 personnel – train approximately 340 additional personnel in core VAW and VFA NECs</p> <p>5. Incorporate and regularly test CNA planning framework to ensure rapid, standardized mitigation of unplanned schedule changes</p> <p>6. Targeted NMETL, CBTRM, SFRM and SFEM revisions to reflect high-end training standards and adequate resourcing for expanding training entitlements</p> <p>7. Further analysis of optimal means to maintain CSG integrity and meet desired deployment dates at a high level of proficiency</p>	<p> durations for CSG training in order to execute the recently established Advanced Phase. In the Advanced phase, WDCs conduct advanced tactical training in all warfighting required operating capabilities. The recently established SWATT is an example. Included in the Fleet Training Continuum revision is the Fleet-wide LVC Training Capability Policy Statement which states that an integrated live, virtual, constructive training capability will be used to train Navy forces to high-end threat conditions. The focus is on live training augmented by virtual and / or constructive where necessary and appropriate without detracting from the Fleet Synthetic Training (FST) program. As examples, this includes adding virtual / constructive effects to COMPTUEX as well as maintaining the FST family of exercises while allowing those programs to change over time to accommodate new technologies and new realities. Once the Fleet-wide policy documents (e.g., FTC, OFRP) are promulgated, subordinate policy documents (e.g., CVTRM, SFRM, and SFEM) will be revised to reflect higher level guidance. It would be premature to update these subordinate policy documents until higher-level guidance is promulgated. The Fleet Training Continuum directs TYCOMs to conduct review of NMETLs annually and update as required to ensure inclusion of mission essential tasks, near-peer conditions, and high-end performance standards required for mission success</p> <p>* USFF leads the OFRP CFT in coordination with CPF that generates a common dashboard, the Master OFRP Plan (MOPP) for CSG/CRUDES, ARG, SSN, MPRA, NECC, MSC and LCS that covers 9 years into the future. The MOPP incorporates inputs from the Surface and Aviation Master Plans which includes force schedules, analysis of schedules/employment,</p>

Report/Study	Overview	Recommendations	Actions taken
			<p>force updates (assumptions, limiting factors, and environment), force PESTO review and commanders recommendations. The process provides cross community participation to ensure OFRP lessons learned are shared across the fleet. USFF also implemented a Strike Group Baseline Configuration Change Plan (BCCP) to improve coordination and planning for future Strike Group deployment planning based on planned equipment/systems for future deployments.</p> <p>* Under OFRP, all units train to a high end performance standard for all required operational capabilities, resulting in all units deploying certified to conduct full scale operations. OFRP maximizes periods of employability for sustainment, deployments and surge capacity providing a more robust force available to respond. As OFRP achieves steady state with steady predictable schedules, more ships will be available for emergent response</p> <p>* To attain OFRP NEC Fit targets Fleet-wide, we recommend that the Navy train an additional 6,600 personnel in the appropriate NECs. More specifically, in order to simultaneously man five CSGs at OFRP manning levels, thereby supporting OPNAV Ao and OFRP LOE 9, we recommend that the Navy increase VAW and VFA manning by approximately 150 personnel. In doing so, it should focus specifically on Chief Petty Officer manning and core maintenance ratings. In addition, to meet this Ao target, we recommend that the Navy train roughly 340 additional personnel in core VAW and VFA NECs</p> <p>* Prior to OFRP, training and certification of independent deployers was based on planned deployment instead of a full range of missions to support the high end, near peer. Once deployed, these units could be reassigned to other mission areas that</p>

Report/Study	Overview	Recommendations	Actions taken
			<p>were not certified. Under OFRP, training and certification of independent deployers are assigned to and train with carrier strike groups to the full range of missions. By training to the high end performance standards for all required operational capabilities, a ready force is provided to Combatant Commanders to mitigate unplanned schedule changes</p> <p>* Strike Group schedules are optimized to align the required maintenance periods of CVN, CRUDES and aircraft. Strike Group composition is adjusted when one or more of these units do not align with the CVN maintenance periods. Aligning the maintenance, training and employment provides the best CSG integrity at a high level of proficiency</p>
<p>Report 9: Actions Needed to Ensure Proper Size and Composition of Ship Crews (GAO report – May 2017)</p>	<p>In 2001, the Navy began reducing crew sizes on surface ships through an initiative called optimal manning, which was intended to achieve workload efficiencies and reduce personnel costs. In 2010, the Navy concluded that this initiative had adversely affected ship readiness and began restoring crew sizes on its ships. This report examines (1) any trends in ship</p>	<p>Conduct a comprehensive reassessment of the Navy standard workweek and make any necessary adjustments:</p> <ol style="list-style-type: none"> 1. Update guidance to require examination of in-port workload and identify the manpower necessary to execute in-port workload for all surface ship classes; 2. Develop criteria and update guidance for reassessing the factors used to calculate manpower requirements periodically or when conditions change; and 3. Identify personnel needs and costs associated with the planned larger Navy fleet size, including consideration of the updated manpower factors and requirements 	<p>* This is a NAVMAC function and has already been implemented. The SNWW was adjusted ~ 2 years ago and they have begun conducting in-port workload studies by Class. DDG 51 Class was the first and study has not been released</p>

Report/Study	Overview	Recommendations	Actions taken
	<p>operating and support costs and maintenance backlogs, (2) the extent to which the Navy's manpower requirements process accounts for ship workload, and (3) any manning challenges and implications for the future</p>		

9.9 History of Surface Warfare Officer School

Evolution of Division Officer Training

From Ensign (O1) through Lieutenant (O3)

Chronology of major events in Division Officer Training:

1970: 6-week pilot course, known as the Surface Warfare Officer Basic Training, stood up at the Naval Destroyer School in Newport RI.

1974: SWO Basic Training expanded and renamed the Surface Warfare Officer Division Officer Course or "SWOSDOC"; second course formally stood at SWOSPAC Coronado, CA.

1975: SWOSDOC increased to 16 weeks in length. Naval Destroyer School renamed to the Surface Warfare Officers School Command (SWOSCOLCOM). Ship handling and navigation training provided through two 8-hour underway sessions on yard patrol craft (YPs) until 1993.

1993: SWOSPAC Coronado dis-established as part of BRAC; all SWOSDOC courses consolidated in Newport, RI.

2003: 16-week formal division officer training (SWOSDOC) dis-established and training shifted to the fleet. Accession officers sent directly to their ships and given the entirety of the SWOSDOC curriculum on a set of compact disks to be learned aboard the ship ("SWOS in a Box"). After approximately 1 year aboard ship, Ensigns required to return to SWOS Newport for a 3-week course (Advanced Ship handling and Tactics course /ASAT), as a pre-requisite for final SWO qualification. ASAT focused heavily on ship handling training - Conning Officer Virtual Environment (COVE) simulator / instructor-facilitated.

2008: SWOS in a Box recognized as inadequate to properly prepare accession officers. COMNAVSURFOR directed the creation of a 3-week Surface Warfare Introduction (SWO Intro) course at Afloat Training Groups San Diego and Norfolk and at SWOS Newport.

2012: SWO Intro and ASAT dis-established and replaced with an 8-week Basic Division Officer Course (BDOC) at SWOS Newport. Approx. 100 hours out of the total 320 hour course dedicated to Navigation, Seamanship and Ship handling (NSS) including 24 hours in the COVE I simulators.

2014: 4-week Advanced Division Officer Course (ADOC) established for Division Officers headed to their Second Division Officer Tours. Training includes 54-hours of additional NSS material including approximately 24 hours in the COVE simulators. The stand-up of ADOC marked the re-establishment of a critical formal schoolhouse continuum for Division Officers since 2003.

2016: BDOC expanded to 9 weeks and ADOC expanded to 5 weeks. The expansion of both courses included additional NSS training.

Division Officer Courses Defined:

The **Basic Division Officer Course (BDOC)** is an intensive, 9-week course of instruction delivered in the Norfolk and San Diego fleet concentration areas and designed to provide foundational classroom training, augmented by hands-on training (ship handling simulators, practical application, ship visits, etc.) to prospective surface warfare officers. The course places emphasis on in-class instruction and the use of technology such as the Conning Officer Virtual Environment (COVE) simulators, which simulate every class of ship in the U.S. Navy and all their homeports, in addition to many routine ports of call around the world. COVE allows for the reinforcement of concepts in navigation, seamanship, and ship handling. The course also provides instruction on division officer fundamentals, maritime warfare, engineering, leadership, and damage control. BDOC training facilities in Norfolk and San Diego have been equipped with state-of-the-art electronic classrooms and ship handling simulators to deliver the required training. The course has an annual throughput of 800 to 900 officers.

BDOC provides 81 hours of classroom instruction on Navigation Seamanship and Ship handling (NSS) topics plus 32 hours of COVE simulator training. Note: By November 2017, additional training will be implemented including 1 hour of classroom instruction on Bridge-to-Bridge communications plus 2 hours of practice in the COVE simulator, and 6.5 hours of classroom training on ARPA plus an additional 4.5 hours of practice in the COVE simulator, bringing the total to 88.5 hours of classroom instruction and 37.5 hours of COVE simulation for a total of 126 hours of NSS training.

The **Advanced Division Officer Course (ADOC)** is an intensive, 5-week course of instruction in Newport, RI that is designed to reinforce and build on the core concepts introduced in the Basic Division Officer Course by pairing them with fleet experience through practical application, simulation, and discussion. This course advances the knowledge of the student through 200 hours of intensive professional military training. The objective of ADOC is to prepare juniors officers to effectively perform as a "Fleet Lieutenant"; a consummate special evolutions Officer of the Deck, expert trainer of watch standers "under instruction", and an Officer ready to undertake qualification in advanced warfare and engineering watch stations. The course has an annual throughput of 800 to 900 officers.

ADOC provides 37 hours of NSS classroom instruction and 31 hours of COVE simulation training for a total of 68 hours of NSS training.

Evolution of LCS Training

Ship handling and Bridge training for LCS:

In 2007 a 6-week Littoral Combat Ship Officer of the Deck (LCS OOD) course and an 8-week LCS Junior Officer of the Deck (LCS JOOD) course were established at SWOS Newport using COVE simulators designed to the specific LCS-1 and LCS-2 Bridge configurations. Training courses remain the same in 2017.

In addition to ship handling and navigation training for the LCS class, SWOS also provides engineering training. Since 2009, SWOS has provided Readiness Control Officer (RCO/EOOW) training to prospective engineering officers assigned to LCS class ships. The training is delivered through the use of the Virtual Maintenance Performance Aid (VMPA) which enables the student to step away from the RCO console and move about the ship via the use of an avatar.

In December 2016, SWOS fielded the 26-week Engineering Plant Technician (EPT) course for both LCS-1 and LCS-2 class ships. This course of instruction uses an Immersive Virtual Shipboard Environment (IVSE) to provide prospective EPTs detailed instruction on LCS engineering systems, operating procedures, and casualty control procedures.

The first EPT student completed the entire course in 13 weeks. Feedback from the fleet on EPT graduates has been extremely positive. An updated RCO course, using the IVSE technology, and an engineering team trainer (ETT) is also under development with scheduled implementation in FY-18. EPT, RCO, and ETT courses also provide rapid refresh for LCS crews.

Evolution of Department Head Training

From Lieutenant (O3) through Lieutenant Commander (O4)

Chronology of major changes to Department Head Training:

1961: The Naval Destroyer School established at Newport, RI; new program designed to train prospective destroyer department heads to perform in challenging at-sea billets. Course subsequently expanded to 24 weeks.

1975: Various surface warfare officer courses of instruction, including SWOSDOC, DH, PXO, and PCO, consolidated under a single command known as the Surface Warfare Officers School Command (SWOSCOLCOM, but referred to as “SWOS”)

2013: As part of the Surface Warfare Command Qualification Process, a command assessment for post 1st tour Department Heads established at Newport.

2016: Department Head training pipeline realigned with other non SWOS delivered Department Head pipeline training courses.

Note: Since its inception in 1961, the Department Head Course has remained a cornerstone and flagship training program for the Surface Warfare Officer community. Over the past 56 years, course length has remained relatively stable, averaging 24 to 27 weeks in length.

Department Head Course Defined:

The **Surface Warfare Officer Department Head Course** is a highly intensive 27 week course of instruction taught at SWOS Newport. The course provides students the training needed to go on and fill Department Head assignments aboard Surface ships as an Operations Officer, Chief Engineer, Weapons Officer, Combat Systems Officer, Plans and Tactics Officer or as a First LT aboard amphibious ships. The course is broken down into four distinct segments: (1) 12 weeks of Maritime Warfare Training which prepares students to stand the Tactical Action Officer (TAO) watch, (2) 3 weeks of navigation, seamanship, and ship handling training in the classroom and in the COVE simulators to refresh and reinforce mariner skills, (3) 5 weeks of Command Management that focuses on leadership, training, administration, and safety, and (4) approximately 6 to 8 weeks of billet specific training. The course has an annual throughput of 250 to 300 officers.

During the Department Head course, students are provided 24.5 hours of NSS classroom instruction and 24 hours of COVE simulation training in addition of 40 hours of Bridge resource management (BRM) training for a total of 88.5 hours of NSS training.

Evolution of Senior Officer Training

From Lieutenant Commander (O4) through Captain (O6)

Chronology of Major Changes to Senior Officer Training:

1967: Prospective Executive Officer (PXO) and Prospective Commanding Officer (PCO) courses of instruction stood up at the Naval Destroyer School in Newport, RI.

1976: Based on concerns with the material condition of the fleet, the Senior Officer Ship Material Readiness Course (SOSMRC) stood up in Idaho Falls, ID as part of PCO pipeline training. Training included a dedicated week underway aboard ship to reinforce classroom training.

1987: Major Command Course (MCO) stood up.

1996: SOSMRC program dis-established and the majority of the material readiness curriculum incorporated into the expanded PCO course.

2000: PCO course consolidated to 8 weeks plus a 1 week ship ride; PXO course consolidated to 6 weeks. In addition, following a number of at sea mishaps, a 5-day Bridge Resource Management course developed at Marine Safety International implemented for PCO training. The course shifted to SWOS Newport in 2005.

2009: In preparation for the SWO XO / CO Fleet Up, the PXO course is dis-established and the course material is incorporated into the new 9-week XO / CO Fleet Up course in Newport.

2010: Based on concerns with fleet material readiness expressed in the Balisle report, SOSMRC re-established at SWOS Newport as a stand-alone 5-week course of instruction which included a 1 week ship ride / ship visit capstone event. As before, attendance at SOSMRC preceded attendance of PCO. XO / CO Special Mission course of instruction stood up.

2012: At the direction of the SOSMRC Board of Visitors in February, the XO / CO Special Mission course changed to the C5I / CVN AUXO course at the direction.

2013: 13-week Surface Commanders Course (SCC) stood up combining SOSMRC with XO / CO Fleet up into a single integrated course of instruction. Additionally, as part of the Surface Warfare Command Qualification Process, a command assessment implemented for all post 1st tour Department Heads.

2016: As part of the 18-3-18 program, a 2-week PCO course stood up for officers in between completing their tours at XO and before taking command. SCC course is reduced to 10-weeks. Focus of the new PCO course: warfighting, leadership, and command management.

Senior Officer Training Courses Defined:

The 10-week **Surface Commanders Course (SCC)** focuses Prospective Executive and Commanding Officers on the tactical, operational, navigation, seamanship, shiphandling, material readiness, and command management skills necessary to excel in command. The curricula culls the best practices from actual waterfront experiences, case studies, subject matter experts, and post-command mentoring sessions to identify where fleet leadership has encountered and overcome obstacles to better planning, training, and execution of operational tasking. Embedded within the Surface Commanders Course is the Senior Officer Shipboard Material Readiness Course (SOSMRC), which provides students the necessary background and tools to assess, monitor and improve ship material readiness. The course has an annual throughput of approximately 120 Officers.

During SCC, students are provided 29 hours of NSS classroom instruction and 24 hours of COVE simulation training in addition to 40 hours of BRM training for a total of 93 hours of NSS training.

The **Prospective Commanding Officers (PCO) Course** is a transitional course which provides an enhanced tailored professional development opportunity as officer's transition from XO to CO afloat. This course currently provides PCO's with 2 weeks of tailored training focusing on advanced management, leadership and tactical development. The curricula is developed from the best practices from actual waterfront experiences, case studies, subject matter experts and post-command mentoring sessions to identify where the fleet leadership has encountered and overcome obstacles to better planning, training, and execution of operational tasking. CY16 throughput - 17 (course pilot/start up) with up to 100 anticipated in CY17 (all O-5 / O-4 fleet up officers - 10 convenings)

The **Major Command Course (MCO)** is designed to prepare prospective Major Commanders, all of whom have had previous command, with the tactical, operational, material management, navigation, seamanship and ship handling skills necessary to excel in major and follow-on sequential command tours. The Major Command course of instruction also contains tailored training based on the student's experience and ultimate billet and is reinforced through interactive lectures, seminars, simulators, case studies and group discussion with subject matter experts. The MCO course also addresses CSG/ARG warfare commander responsibilities and as well as Immediate Senior in Command (ISIC) responsibilities. CY16 throughput – 44. CY17 Planned – around 50 students (5 convenings).

During MCO, students are provided 31 hours of NSS classroom instruction and 20 hours of COVE simulation training for a total of 51 hours of NSS training.

Evolution of Ship Handling and Navigation Training

Pre-2002: Ship handling training provided to 400 Department Head, PXO, PCO, and MCO students through a contract with Marine Safety International (MSI) annually. Individuals received training in notionally three 4-hours sessions with 2-3 other officers.

2000: At the request of SWOS, Marine Safety International developed a 5-day Bridge Resource Management (BRM) course of instruction for all PCO students.

2003: With support from the Office of Naval Research (ONR) and the Naval Air Warfare Center Training Systems Division (NAWCTSD) Orlando, SWOS developed an organic ship handling training capability called the Conning Officer Virtual Environment (COVE) and the following year ship handling training for DH, PXO, PCO, and MCO students shifted from Marine Safety International to SWOS. Amount of ship handling training increased from approximately 12 hours to 24 hours.

2005: The 5-day BRM course shifted from MSI to SWOS. Note: In 2011, the SWOS BRM course was certified (5-year certification) by the U. S. Coast Guard.

2007: 6-week Littoral Combat Ship Officer of the Deck (LCS OOD) course and an 8-week LCS Junior Officer of the Deck (LCS JOOD) course established at SWOS Newport using COVE simulators designed to the specific LCS-1 and LCS-2 Bridge configurations.

2010: OPNAV N96 and COMNAVSURFOR-sponsored Surface and Expeditionary Warfare Training Committee established to better align available resources to Surface training requirements. SWOS assigned as the Navigation Mission Area Chair (MAC). First SEWTC-approved Surface and Expeditionary Warfare Training Plan (SEWTP) (POM-13) includes over \$30M in navigation improvements to include additional COVE simulators for SWOS, VMS trainers, LCS trainers, Navigation Systems Technician training, and sustainment for the BDOC COVE simulators.

2011: In the wake of the PORT ROYAL grounding off Hawaii, a 4-week Surface Navigator (SURFNAV) course stood up at Newport for all Surface Navigators. Course later increased to 5 weeks. New course focused on traditional paper chart plotting as the foundation for understanding and operating electronic navigation, but also contained over a week of dedicated voyage management system training. Course also restored celestial navigation training. Additionally, the SWOS BRM course was certified by USCG (5-year certification).

2012: As part of CNO's Navigation Senior Steering Group (SSG), a comprehensive Surface Navigation Training and Manpower Review conducted by SWOS to identify shortfalls in officer and enlisted navigation training.

2013: Wholeness Review results published in 2013, reviewed at the 2013 Navigation, Seamanship and Ship handling Board of Visitors (BoV), and subsequently briefed to the four-star Fleet Commanders Readiness Council (FCRC) for endorsement. SWOS recommendations included (1) rebuilding the Quartermaster training continuum, (2) substantially revising QM A-School, creating journeyman level C-School and master-

level QM training, (3) establishing QM NECs, standardizing navigation accession training across USNA, NROTC, and OTC, (4) providing navigation training for non-QM ratings, and other improvements. \$27.1M in POM-16 investment approved by the SEWTC to resource SWOS-recommended improvements in addition to establishing COVE training in Bahrain and Rota for forward deployed forces. OPNAV N96 (Admiral Rowden) directed \$800K in execution year funding to accelerate the delivery of the SWOS POM-16 improvements. BRM course recertified (5 year certification) due to turnover of personnel.

2014: SWOS assumed responsibility for all Quartermaster (QM) training. At the time, the QM training continuum consisted of 8-weeks of QM A-School in Great Lakes with follow on VMS training in the fleet concentration areas (FCA) and the 2-week Senior QM Refresher course, also taught in the FCAs. There was no NEC producing journeyman level or master level training at that time. In 2015, SWOS established the 0202 NEC producing, 5-week Assistant Navigator course in Newport for all prospective ANAVs and in 2016 established the 0203 NEC producing, 3-week QM Journeyman course (C-School) in the FCAs. The first 0203 Journeyman-level NEC was awarded in 2017.

QMs graduating A-School are VMS trained in the Fleet Concentration Areas (Norfolk, San Diego) either before or shortly after reporting aboard ship. Training is conducted with same version of VMS existing on their ship. When a ship is upgraded to a newer version of VMS, the installation vendor provides onsite “difference training” between the old and new systems if within the same version (e.g. 9.3 to 9.4). If the ship is upgraded from version 8 to 9 for example, the QM must complete the full VMS course on the new system.

2016: COVE III simulators fielded in Newport, RI and at (1) Bath, ME, (2) Pascagoula, MS, (3) Rota, Spain, and (4) Bahrain to support PRECOM as well as Forward deployed ship handling and navigation training. Navigation SAGT established for PC and MCM class ships in Bahrain.

2017: Preparations for the May 2017 Navigation, Seamanship, and Ship handling Board of Visitors (BoV) conducted by SWOS and CSCS in San Diego, Norfolk, Mayport, Pearl Harbor, Everett, Sasebo, and Yokosuka fleet concentration areas to solicit direct feedback from the Fleet and the waterfront and to identify shortfalls in NSS training. Some 110 individual issues were identified, reviewed and vetted by an Advisory Board of O-6 representatives, and 19 major issues were subsequently briefed to the Surface Community flag leadership for further action. The BRM course 5-year recertification was recently approved in October 2017. The certification is good until 2023.

Seamanship and Shiphandling Simulators Defined:

The Surface Force employs two types of ship handling simulator architectures: (1) The Conning Officer Virtual Environment (COVE) simulators employed by SWOS at the various SWOS learning sites, by SWOS and CSCS at Littoral Combat Ship Training Facilities (LTF), and by the Naval Service Training Command (NSTC) at several NROTC units, and (2) the Navigation Seamanship and Ship handling Trainers (NSST) employed by COMNAVSURFOR and COMNAVSURFLANT at the FCAs for shipboard individual and team training.

Conning Officer Virtual Environment (COVE) simulator provide state of the art navigation and ship handling training for all of our Surface Officers. Trainers emulate every U.S. Navy homeports in addition to almost every routine port of call around the world. There are two types of COVE stations.



COVE I stations are used primarily for BDOC and ADOC students. These stations consist of a virtual reality (VR) helmet that gives them a 360-degree view of their surroundings. Using a state of the art voice recognition system, students can give commands to the virtual helmsman, which are repeated back by the computer. SWOS employs 36 x COVE I stations across the domain: 9 at BDOC Norfolk, 9 at BDOC San Diego, and 18 at SWOS Newport. NSTC

operates 10 x COVE I stations at various NROTC sites to include Old Dominion University, Boston University, Jacksonville University, and San Diego State College.



COVE 3 stations have the same functionality as the COVE I stations except they are viewed on three 50-inch displays to allow the student a wider field of view. The COVE 3 stations are primarily used by our Surface Navigator, Department Head, Surface Command Course, PCO and Major Command students. SWOS operates 8 x COVE 3 stations in Newport. There are four additional COVE 3 stations in use: 1 in Bath, 1 in Pascagoula, 1 in Rota, and 1 in Bahrain.



Full Mission Bridge simulates every Navy homeport and regular ports the Navy visits around the world, providing the student with a 360 degree realistic virtual environment. Various students train in the Full Mission Bridge from newly commissioned Ensigns through Captains. Department Head students practice Anti-

Terrorism and Force Protection (AT/FP) tactics using the full mission Bridge and like the Prospective Commanding Officer and Prospective Executive Officer (PCO/PXO) students along with Major Command students practice Bridge Resource Management (BRM). The Full Mission Bridge can simulate all naval surface platforms, which allows almost every student that comes through SWOS to train, through simulation, on the actual ship they will be serving on. To view more pictures please click on the thumbnails below. There are two FMBs at SWOS Newport.



The Littoral Combat Ship Full Mission Bridge is a full sized trainer that students with orders to LCS ships can train on in preparation of reporting to their new command. Using the same software as FMB and COVE, the LCS trainer has every Navy homeport modeled and allows LCS student to navigate in and out of designated ports using the highly sophisticated controls of a real LCS. The LCS Bridge trainers are installed at SWOS Newport and at the Mayport and San Diego LTFs

Navigation Seamanship and Ship handling Trainers (NSST) provide a shore-based ship handling training for individuals and watch team training in all of the FCAs and are operated at the direction of the Surface Type Commanders. Two major NSST variants were fielded: the v1.0 for individual training, which was primarily designed for shipboard use but the program was subsequently discontinued and the v2.0 for team training ashore. The first shore-based simulators were fielded in Yokosuka and Sasebo, Japan, and at the U. S. Naval Academy in 2004. The first NSST v1.0 was fielded aboard ship in 2006. By 01 May 2011, there were 84 NSST v1.0 trainers installed aboard FFG, DDG, and CG class ships (and at FCA shore sites), ten (10) NSST v2.0 simulators were installed at facilities in the seven FCAs (Norfolk, San Diego, Mayport, Everett, Pearl Harbor, Yokosuka, and Sasebo) and the U. S. Naval Academy in addition to two Bridge wing simulators (BWS) – one each in Norfolk and San Diego – and two RHIB simulators – one each in Coronado and Little Creek.

9.10 Classified Appendix

This classified appendix provides supplemental details to Chapter 6.